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URETERAL TRANSPLANTATION FOR EXSTROPHY OF THE BLADDER

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OF the congenital anomalies, exstrophy of the urinary bladder is one of the most interesting. This condition, which is brought about by the incomplete development of the urogenital system, is not common. According to Spooner, it occurs on an average of about once in every 18,000 to 20,000 births. Others state that the anomaly occurs as infrequently as once in 55,000 births. Unless some measures are taken to correct the condition, or to compensate for it, the individuals in whom it occurs are chronic invalids throughout life, and because of the constant, uncontrolled flow of urine they are a nuisance to themselves and to others who are around them.

The development of the urinary system and the reproductive system is so closely related that when a congenital anomaly is found in one system it is not uncommon to find one or more deformities in the other. Epispadias and hypospadias, and even hermaphroiditism may be found. Several times we have observed a bifid uterus in connection with exstrophy of the bladder.

Occasionally at the time of operation in cases of exstrophy of the bladder we have seen ureters of enormous size. In a few cases the ureters were as large as an adult's finger. In some instances these were not transplanted at the time of the first operation, but the ureteral orifice was slit at the base of the bladder, allowing a freer flow of urine. The patients were operated on again in a few months, at which time the ureters were found to be diminished considerably in size and were successfully transplanted into the sigmoid.

According to Englemann's study of the ureters, their musculature is composed of an external, circular coat and an internal, longitudinal coat. By contraction of these muscular layers the urine is carried along from the pelvis of the kidney to the bladder. The contractions occur at rhythmic intervals of from ten to twenty seconds; the wave begins at the kidney and passes downward. If the outlet of the ureters were partially obstructed, the constant ureteral movements would be causative factors in the distention or dilatation of the ureters, such as was noticed in some of our cases.

The earlier methods resorted to for correction of exstrophy of the bladder consisted of various types of plastic operations. These were never successful, mainly for two reasons: (1) It was almost impossible to close this abnormal rudimentary bladder; (2) if success were met with in closing the bladder, there still was the impaired nervous mechanism of micturition, and often sepsis set in and the patients died.

After most dismal failure in reconstruction operations for this condition, certain surgeons attempted to implant the ureters into the intestine. This met with success in only a small percentage of cases, chiefly because the ureters were implanted into the intestine after the fashion of the Witzel type of enterostomy or gastrostomy. In this method a tube is placed directly in the lumen of the viscus, and the walls of the stomach or of the intestine are then sutured over the tube. The transplantation of ureters by this scheme is not satisfactory. The placing of the ureter directly into the lumen of the bowel frequently caused leakage from the bowel, from the ureter, or from both. Moreover, if the wall of the bowel were stitched firmly over the ureter, obstruction to the urinary outflow occurred and caused hydronephrosis; this was followed by infection and death unless the pelvis of the kidney was drained and drainage frequently established a permanent urinary fistula. If the tube was stiff, to avoid kinking, gas was forced upward from the intestine and the result was chronic infection of the kidney and distention of the ureter and renal pelvis.

Coffey, in 1911, called attention to the fact that the common

bile duct, the salivary ducts, and the ureters pass through the muscularis and continue for some distance between the muscle and the mucous membrane before entering the lumen or cavity at which they terminate. Since this discovery, a method of ureteral transplantation has been employed, in which the ureter is led between the muscle and mucous membrane before entering the lumen of the bowel. The results have been uniformly encouraging. Tension closes the ureter by compression without obstructing its own peristalsis.

In 1926 Mayo and Hendricks published a report of the technic of ureteral transplantation which had been used successfully in a large number of cases during the preceding fifteen years. In the last three years this method has been somewhat modified; it is less difficult, and we think it offers some improvement over the method previously described.

By this modification ureteral transplantation into the sigmoid colon has been done, without fatality, in fifteen cases of exstrophy of the bladder. The ureters have not been transplanted simultaneously in any case. Coffey transplants both ureters at the same time and he is encouraged by his results. We have felt that in most cases implantation of the ureter into the sigmoid is followed by pyelitis; although this is not severe, it has seemed wise to us to transplant one ureter at a time. Thus, one kidney is left to function as it had been functioning until the other kidney and the colon can adjust themselves to the new position of the ureter; moreover, the time of operation is lessened. We believe that following the transplantation of the first ureter the colon absorbs the urine for a few days, that afterward absorption does not occur, and that when the other ureter is transplanted, little if any absorption takes place.

TECHNIC OF OPERATION

An entirely satisfactory method of treatment of exstrophy of the bladder was not obtained until the ureters were transplanted into the sigmoid, and the bladder subsequently was removed. This type of treatment, as carried out by us, has proved entirely satisfactory in a large number of cases. The operation is per-

formed in three stages. The right ureter is transplanted first. Ten days later the left ureter is transplanted, and after an interval of about a week, the bladder is removed. If the left ureter is transplanted first, the sigmoid becomes fixed in the left iliac fossa, making transplantation of the right ureter more difficult. It has been the experience at The Mayo Clinic that transplantation of both ureters simultaneously is not a satisfactory method.

The method we now use consists in isolating the right ureter from its normal retroperitoneal position. The ureter is cut off near the bladder and ligated; the end distal to the cut is withdrawn later, at the time when the bladder is removed. The opening in the peritoneum is then closed. Next, four or five small, horizontal niches are made through the serosa and muscular coats of the sigmoid, a segment of which has been isolated and held in position by means of curved, rubber-covered clamps. With small forceps the serosa and muscular coats are tunneled, just outside the mucosa, from one niche to another. Through this interspaced tunnel a piece of catgut suture is passed and the upper end of the suture is stitched firmly into the end of the ureter. Before the ureter is inserted into the bowel the loose end of the catgut is passed about 6 cm. into its lumen; this permits urine to trickle along the ureter even if it should be compressed and kinked.

Then the ureter is drawn through the tunnels by traction on the catgut. At the lowest opening a small opening is made in the mucous membrane of the sigmoid. The end of the ureter is placed in this opening, and a curved needle is slipped over the free end of the catgut which previously was attached to the ureter. The needle is passed through the opening into the lumen of the sigmoid and out through the entire thickness of the wall of the sigmoid about 1 to 1.5 cm. below the insertion, drawing the ureter within the lumen of the bowel. This stitch holds the ureter in place. Several interrupted sutures are used which include the serosa and a small portion of the ureteral wall at the points where the small openings in the peritoneum and muscle previously were made. By means of a second row of sutures the

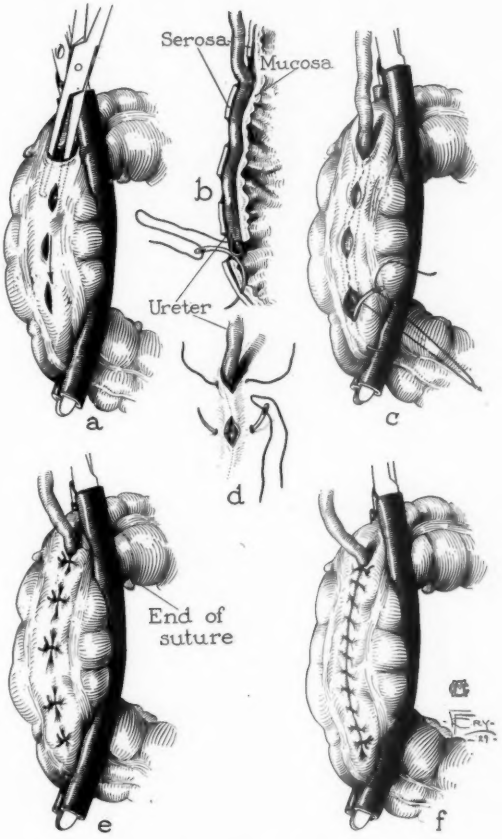

FIG. 1.—Method of transplantation of the ureter into the sigmoid colon: *a*, Isolation of segment of sigmoid, series of small, horizontal niches through serosa and muscular coats, and tunnelling from one niche to the other through serosa and muscular coats; *b*, ureter pulled through tunnel by traction on catgut. An opening in the mucosa has been made. The needle that is threaded over the piece of catgut passes into the lumen of the sigmoid and out through its walls; *c*, another view of substantially the same steps as those shown in *b*; *d* and *e*, interrupted sutures which include serosa and a small portion of the ureteral wall at points where niches were made; *f*, second row of sutures over the primary suture line.

serosa is approximated over the primary suture line. The ureter must not be compressed in the tunnels or by the sutures. The sigmoid is then rotated outward until the suture line is in contact with the iliac peritoneum and it is held there by a few interrupted sutures. The abdomen is closed without drainage.

In a few days the left ureter is transplanted after a similar fashion. About one week after the second stage the bladder is dissected out, leaving a rather large raw surface which heals by granulation rather rapidly except, usually, for two or three small pin-point areas which mark the sites of the seminal vesicles.

SUMMARY

Transplantation of the ureters in exstrophy of the bladder is the most satisfactory treatment for this condition. More particularly has this been true since Coffey's suggestion has been followed, namely, that the ureter be passed for some distance between the muscular layers before it should be implanted into the lumen of the bowel.

Exstrophy of the bladder, although rare, is probably quite frequently unrecognized as other than a congenital deformity of undetermined nature. At The Mayo Clinic more than 100 cases have been seen since 1901.

Before ureteral transplantation is made it is necessary to make certain that the sphincters of the anus are functioning normally. If control of this mechanism is lacking, little is accomplished by adding urine to the intestinal content.

The operation is best done in children aged more than three years. By that age children are able to attend to their own toilet. However, under certain circumstances, we have done several operations for exstrophy in patients younger than three years.

We believe it is best to do the operation in three stages, transplanting the right ureter first. After an interval of ten to twelve days the left ureter is transplanted. Usually in one week after the second transplantation the bladder can be removed.

In most cases pyelitis develops temporarily, and there is a rise in temperature of from 1 to 3 degrees, lasting from a few days to a week. For a short time when the ureter is first transplanted the colon absorbs some of the salt urine.

VESICOSIGMOIDAL FISTULA; GASTRO-INTESTINAL HEMORRHAGE IN A CASE OF APPENDICITIS AND IN A CASE OF CHRONIC CHOLECYSTITIS WITH CHOLELITHIASIS; EXCISION OF GASTRIC ULCER AND POSTERIOR GASTRO-ENTEROSTOMY; LESIONS OF THE KIDNEYS

E. Starr Judd, James M. Marshall, and Shattuck W. Hartwell

VESICOSIGMOIDAL FISTULA

Case I.—A married woman aged seventy-seven years was admitted to the clinic August 23, 1929. Ten years previously she had had an ischiorectal abscess that had spontaneously drained externally and had healed. Otherwise the medical history was essentially negative. A year previous to admission she had begun to have pain in the region of the bladder, frequency, urgency, and burning on urination, and she had noticed the passage of fecal material in the urine. These symptoms gradually had become more severe until at the time of admission she was voiding every fifteen to thirty minutes. Her general health had markedly declined during the year and there had been loss of weight of 30 pounds.

The patient was emaciated and weak, but otherwise in fair general condition for her age. On bimanual examination, considerable thickening and fixation of tissues was palpable high in the posterior vaginal vault. The urine in the bladder contained much pus and a few erythrocytes, but the urine from each kidney was clear. The concentration of hemoglobin was 60 per cent; erythrocytes numbered 3,900,000 and the leukocytes 8,600 for each cubic millimeter of blood. Cystoscopic examination revealed marked chronic areal cystitis. A functional test of each kidney separately disclosed a normally functioning kidney on each side. Proctoscopic examination for a distance of 18 cm. within the bowel gave negative results. Roentgenologic examination of the colon was not made.

Exploration, August 28, 1929, revealed a hard, firm mass in the sigmoid portion of the colon, firmly adherent to the posterior wall of the urinary bladder. On separating the sigmoid portion of the colon from the bladder it was found that there was a communicating opening between them about 1 cm. in diameter. The edges of the opening in the bladder were freshened; the hole was closed with plain catgut, and the peritoneum was sutured over it. The lesion in the sigmoid seemed definitely to be diverticulitis, but it seemed unlikely that an intra-abdominal closure of the perforation could be made to hold. Therefore the lesion was brought outside the abdominal wall, as the first stage of a Mikulicz operation for resection of the colon, and a catheter was sutured into the perforation to make a temporary colostomy opening. A

retention catheter was left in the bladder. A week later the second stage was done in which the lesion was removed. The pathologist reported multiple diverticula, with peridiverticulitis.

Convalescence from the operations was somewhat slow, but otherwise uneventful. The retention catheter was removed from the bladder on the eleventh day and the patient was allowed to void. There was considerable irritability of the bladder, with marked frequency at first, but this gradually subsided until the patient could hold the urine with comfort for three hours. The patient was allowed to get up and about and to regain her strength. Clamps were applied to the partition between the two ends of the severed loop of bowel November 5, and the colostomy opening was ready for closure when this report was written.

Case II.—A physician aged fifty-four years was admitted to the clinic October 8, 1929, complaining of irritability of the bladder and the passage of fecal material from the urethra. The remote medical history was essentially negative except for diphtheria in 1910, and hemorrhoidectomy and repair of an anal fistula in the same year. In 1925 he had had an attack of cystitis, with chills, fever, general malaise, and extreme irritability of the urinary bladder, with frequency, urgency, and the passage of gas from the urethra following urination. The attack had lasted eight weeks, during which time there had been much pus in the urine. He had then been well for two years, until January, 1927, when he had had a similar attack. Following this he had submitted to abdominal exploration. It was reported that definite communication between the bowel and bladder had not been found, but that many adhesions had been broken up in that region. Following the operation he had remained entirely well for two and a half years. Then, in August, 1929, following the ingestion of calomel, he had had an attack similar to the first, but this time he had passed feces by the urethra. This attack had continued in severe form for one week and then he had submitted to a perineal operation in an attempt to locate the trouble, but a fistula had not been reached. During the succeeding four weeks all symptoms had subsided and he had come to the clinic for examination. During the course of the illness his general health had remained good except during the exacerbations. He had not lost weight and had had no definite gastro-intestinal symptoms.

General examination gave essentially negative results. The urine from the bladder contained considerable pus, twenty-five cells to the high-power field. The concentration of hemoglobin and the blood picture were normal. The Wassermann reaction of the blood was negative and the concentration of blood urea normal. Roentgenologic studies of the thorax, kidneys, ureters, and colon gave negative results. Proctoscopic examination for a distance of 24 cm. gave negative results. On cystoscopic examination an intolerant bladder was found; it was trabeculated, and moderate areal cystitis was present. There was normal function from either kidney. A cystogram was made, which disclosed a communication between the left upper posterior part of the wall of the bladder and the sigmoid portion of the colon (Fig. 2). Both ureters were free and not involved.

Exploration through a low median-line incision revealed old diverticulitis of the sigmoid, with, apparently, a perforation between a single diverticulum and the posterior wall of the bladder. There were many adhesions and considerable scar tissue in this region. The sigmoid colon was dissected off from the bladder; the opening (5 mm. in diameter) was closed with chromic catgut and silk. The opening in the bladder was closed with a continuous suture of chromic catgut. Two small, split-tube drains were used and a retention catheter was left in the bladder.

The catheter was removed on the seventh day, and the drains were removed on the eighth and ninth days. At first the patient voided about every hour, but the interval gradually lengthened, and on the twenty-first

FIG. 2 (Case II).—The opaque medium is shown escaping from the bladder and into the sigmoid.

postoperative day he could retain urine in comfort for four hours. The abdominal wound healed and he left the hospital in good condition on the twenty-first day.

Comment.—These cases often are difficult to diagnose unless the opening between the bowel and the bladder is large enough to allow a considerable amount of feces to escape into the bladder or a perceptible amount of urine to escape into the colon. Frequently the opening is so small that it is hard to demonstrate, and the result is extensive cystitis, with a colon-bacillus

infection of the entire urinary tract. A cystogram frequently will enable one to make a diagnosis in these cases when otherwise it would be impossible, for the roentgen rays disclose the communication between the bladder and the intestine. It was a valuable aid in Case II, for although the patient had symptoms that made the condition evident, the presence of the fistula was proved by the cystogram.

Sometimes it is difficult to determine just what part of the intestinal tract communicates with the bladder, but often it is the sigmoid and the condition the result of perforating diverticulitis. Occasionally a perforating carcinoma of the colon will be found to be the cause of the trouble. A few years ago one of us (Judd) reported two cases in which a communication between the bladder and intestinal tract apparently was due to rupture of the appendix, with formation of abscess. This resulted in a communication between the appendix and the bladder. We have encountered the condition only in the two instances.

Excision of the diverticulum and closure of the opening in the bladder and sigmoid is satisfactory if the opening is single and the remainder of the colon is in good condition. Resection of the sigmoid should be carried out only in cases in which there is a probability of malignancy or in which there are multiple diverticula with obstruction of the sigmoid.

GASTRO-INTESTINAL HEMORRHAGE IN WHICH THOROUGH CLINICAL STUDY AND SURGICAL EXPLORATION FAILED TO REVEAL ABNORMALITIES EXCEPT CHRONIC APPENDICITIS (CASE III) AND CHRONIC CHOLECYSTITIS WITH CHOLELITHIASIS (CASE IV)

Case III.—A married woman aged thirty-six years was admitted to the clinic July 15, 1929. The remote medical history was negative except for mild attacks of influenza, tonsillitis, and pleurisy. The patient complained that for nine or ten years prior to admission she had been subject to intermittent attacks of mild pain in the right lower quadrant of the abdomen that could be relieved by the application of a hot-water bottle and the digital manipulation of the abdominal wall over the cecal area. One year prior to admission had marked the onset of diarrhea that had persisted with no remissions. She had had four to eight watery stools each day that often had contained considerable blood. Abdominal cramps had been frequent and usually had been situated chiefly in the right lower quadrant of the abdomen

and had been temporarily relieved by movement of the bowels. There had been no nausea or vomiting and no constipation.

The patient was in a good state of nutrition although her weight was 10 or 12 pounds less than usual. The systolic pressure was 110 and the diastolic 80, measured in millimeters of mercury. The temperature was normal. On examination the abdomen was held slightly rigid in the right lower quadrant and the cecum was palpable. Concentration of hemoglobin was 66 per cent; erythrocytes numbered 4,050,000, and leukocytes, 7,600 in each cubic millimeter of blood. The result of the differential leukocyte count was normal. Analysis of gastric content disclosed total acidity of 50 and free hydrochloric acid of 30, based on 100 c.c. of gastric content and expressed in terms of tenth-normal solution of sodium hydroxide. Roentgenologic studies of the thorax, stomach, duodenum, and colon were negative. Proctoscopic examination of 24 cm. of the colon gave negative results. Repeated examinations of the stools disclosed only the presence of *Chilomastix mesnili*. Abdominal exploration was decided on.

Abdominal exploration was done July 22, 1929. Thorough examination of the stomach, duodenum, jejunum, ileum, and colon gave negative results. The gallbladder seemed normal. The appendix was definitely inflamed and there were a few adhesions around the cecum. These adhesions were broken up and appendectomy was done. The pathologist reported chronic catarrhal appendicitis with fibrosis of the tip of the appendix.

Convalescence was uneventful and the patient left the hospital on the eleventh day. In a recent communication, four months after the operation, she stated that she had remained well, with no recurrence of the symptoms.

Case IV.—A physician aged fifty-one years was admitted to the clinic September 9, 1929. He had had typhoid fever in 1906 and scarlet fever in 1922. He had also undergone thyroidectomy for an adenomatous thyroid gland in 1905 and bilateral repair of inguinal hernia and appendectomy in 1925. His complaint on admission was of recurring gastro-intestinal hemorrhage. In September, 1927 he had had a sudden attack of melena with weakness, giddiness, and the passing of several tarry stools. Concentration of hemoglobin had been below 50 per cent after this attack. Five weeks later he had had a similar attack and had been in bed for six weeks, during all of which time the stools had contained occult blood. Recovery then had ensued and he had remained in good health until April, 1929, when he had had a recurrence of the melena and had been in bed for ten days. Again, August 10, 1928, the hemorrhage had been repeated. During the course of this illness his general health had remained fairly good and he never had had any associated dyspepsia, nausea, vomiting, or pain.

The patient was moderately obese. The systolic blood pressure was 160 and the diastolic 85; the pulse rate for each minute was 80 and the temperature was normal. General examination of the abdomen was negative, except for the three healed lower abdominal wounds. Examination of the urine and the Wassermann reaction of the blood gave negative results. The concentration of hemoglobin was 17.6 gm. for each 100 c.c. of blood; the erythrocytes numbered 4,750,000 and the leukocytes 4,700 for each cubic

millimeter of blood, and the differential count was negative. Analysis of gastric content disclosed total acidity of 70 and free hydrochloric acid of 52. Roentgenologic studies of the thorax, stomach, duodenum, and colon gave negative results. The cholecystogram gave evidence of a nonfunctioning gallbladder.

Exploration was done September 16, 1929 through an upper right rectus incision. Except for slight duodenitis, the entire gastro-intestinal tract seemed normal. The liver was somewhat larger than normal but there was no evidence of cirrhosis. The gallbladder was definitely inflamed and the cystic duct contained one stone. The only suggestion of intra-abdominal disease was in the gallbladder and liver, and the conclusion at operation was that the condition was one of chronic hepatitis associated with chronic cholecystitis. Cholecystectomy was done.

The pathologist reported chronic catarrhal cholecystitis (strawberry gallbladder, graded 2). The gallbladder contained a small papilloma, less than 2 mm. in diameter, and a small gallstone.

Convalescence was entirely uneventful. The patient left the hospital on the seventeenth day with the wound healed and in good general condition. Symptoms had not returned when this report was written.

Comment.—Recurring gastro-intestinal hemorrhage often presents a difficult problem for the clinician and for the surgeon. The condition is not uncommon. Sometimes it is impossible to find a lesion in the stomach or duodenum that would account for the hemorrhage. On some occasions, the bleeding results from a polyp in the small intestine, or from a malignant condition, colitis, or a polyp in the colon. Undoubtedly, in some instances, changes in the blood are responsible and the bleeding is not due to any lesion in the gastro-intestinal tract. Cirrhosis of the liver, with varices about the esophagus, must also be borne in mind. Some disturbance in the spleen, such as Banti's disease, may be responsible for the hemorrhage. Ulcers in the gastro-intestinal tract may be the cause; so the duodenum should always be investigated even in the presence of a negative roentgenologic examination.

We have observed a series of cases in which operation has been done because of recurring gastro-intestinal hemorrhage, but in which we were unable to find any lesion in the gastro-intestinal tract. Of course, this does not mean that some small lesion did not exist there, but there was none of sufficient size to be recognized by the surgeon. However, in some cases we found

definite inflammation of the gallbladder and in each case the gallbladder contained stones. By removing the gallbladder, and usually the appendix also, we have seemingly produced some change so that, in this series at any rate, bleeding has ceased. We know that removal of the gallbladder does produce remote changes which are not well understood. Furthermore, we have ample evidence of the influence of the liver on some of the factors involved in the coagulation of the blood. It is possible, then, that in some instances recurring gastro-intestinal hemorrhage may result from chronic cholecystitis, with its remote changes. Case IV is one which we believe falls into this group. In this case there was gastro-intestinal bleeding for which we were unable to account. However, there was an area in the duodenum which was suggestive of a little inflammation. We know that severe bleeding may occur in cases of duodenitis even when it is difficult or impossible to demonstrate the presence of an ulcer. We believe that duodenitis may be associated with chronic cholecystitis and hepatitis. In Case IV the only evidence of disease that we could find on complete exploration of the gastro-intestinal tract, liver, pancreas, and spleen, was chronic hepatitis, with definite cholecystitis. Case III is one in which there had been repeated hemorrhages, but we were unable to demonstrate any trouble in the gastro-intestinal tract, liver, or gallbladder. There was definite inflammation in the appendix. We have not often felt that inflammation in the appendix could be the cause of gastro-intestinal hemorrhage and in this case it is possible that we have not analyzed the condition correctly. However, something seems to have been accomplished by removal of the appendix of this patient, because her general condition has improved. It is possible that this chronic infection may have been responsible for all of her difficulty.

Mann and Bollman recently reported their observations of the influence of complete removal of the liver on the factors concerned in coagulation of the blood. They summarized their results as follows: "Following hepatectomy there is no appreciable change in the calcium content of the blood or in the prothrombin content of the blood. Fibrinogen is not altered by

the process of hepatectomy and may remain normal in the blood for a great many hours after hepatectomy. When the fibrinogen is depleted there is absence of regeneration in the absence of the liver. Antithrombin may increase in the absence of the liver and may also decrease in the absence of the liver."

Some of the functions of the liver undoubtedly are important factors in coagulation of the blood and it may be that, in the group of cases under consideration, removal of the gallbladder brings about some changes which compensate for or which readjust the disturbed function.

Case V.—A physician aged forty-eight years was admitted to the clinic October 7, 1929. His complaint was stomach trouble. Twenty years before, for a period of a month, he had had a recurrent, severe, epigastric pain which had been relieved by taking food. He had been well, then, until ten years before he came to the clinic when the trouble had recurred, and he had had periodic epigastric distress since that time, with periods of freedom of one to three months' duration, usually when on vacation. The distress had been a gnawing pain which had occurred when his stomach was empty and which had been relieved by taking food or magnesia. He had vomited often about four or five hours after eating; occasionally he had been awakened at night, and had vomited in the morning food which he had eaten at noon on the previous day. He had been on a diet for ulcer for the last two months, with complete relief.

General examination gave essentially negative results. The blood pressure was 120 systolic and 82 diastolic, and the pulse rate was 72 each minute. The temperature was 98° F. Examination of the urine and the Wassermann reaction of the blood gave negative results. Analysis of gastric content after a test meal resulted in recovery of 385 c.c. of content which had a rancid odor and of which the total acidity was 68 and the free hydrochloric acid 46. Roentgenograms of the stomach gave evidence of a gastric ulcer on the posterior wall and a slight tendency to hour-glass deformity of the stomach, probably due to spasm.

October 10, 1929 laparotomy was performed. A rather superficial ulcer, with a definite crater, was found on the lesser curvature of the stomach 7.5 cm. above the pylorus. There was a considerable degree of gastritis. The lesser curvature of the stomach was excised, from just above the pylorus, for a distance of about 7.5 cm., well around the ulcer. Posterior gastroenterostomy was then performed. Exploration of the gallbladder and appendix did not reveal anything of consequence.

The pathologic report was perforating inflammatory gastric ulcer measuring, in various diameters, 1.5 cm., 8 mm., and 7 mm.

Postoperative convalescence was uneventful. The patient was dismissed from the hospital on the seventeenth postoperative day, apparently well; the wound was healed.

Comment.—Gastric ulcer occurs both as a benign and as a malignant lesion. An important point to be considered in dealing with a gastric ulcer is that it is impossible to tell whether it is benign or malignant until it has been excised and examined microscopically. There are no clinical or roentgenologic signs or any gross features that will enable us to be sure into which group the ulcer falls. For that reason gastric ulcer is always a surgical condition, and the procedure should be such that it will get rid of the ulcer either by excision or by resection.

Undoubtedly, many gastric ulcers have healed of their own accord. Some have been made to heal by proper diet and management, and others have healed as a result of gastro-enterostomy. It is equally true, however, that in some cases in which the patients have been subjected to this conservative treatment, the condition has progressed from an operable state to an extensive, inoperable malignant condition while the treatment was being carried out. A surgeon may be able to speculate with a fair degree of accuracy as to whether the lesion is benign or malignant, but he cannot be certain of its nature until microscopic study has been made.

Gastro-enterostomy alone is not a suitable procedure for the treatment of gastric ulcer, even when the lesion is benign, for experience shows that in many cases the symptoms have persisted and that the lesion has increased rather than decreased. Resection of the stomach is the procedure most frequently carried out at the present time, but it seems to us that this is not indicated when the lesion is small and can be excised without too much resultant deformity of the stomach. Excision of gastric ulcer, combined with gastro-enterostomy, has given better results than almost any other operative procedure for this condition.

In case V the operation was carried out in such a way that the greater part of the lesser curvature of the stomach, as well as the ulcer, was removed. This plan results in wide removal of the lesion, which is a safeguard in case it proves to be malignant. Then, also, excision of most of the lesser curvature prevents recurrence of the ulcer, which is not uncommon following

more conservative treatment. The lesser curvature is excised after the plan of Schumaker, without the use of special clamps. This is accomplished by making a long incision on the anterior surface of the stomach and one on the posterior surface, which takes out the ulcer with the greater part of the lesser curvature. The anterior and posterior walls of the stomach are then sutured together. The pylorus is not removed as in the Schumaker operation. The lumen of the stomach is reduced a good deal, especially if the ulcer is large. However, there is sufficient space on the posteror wall of the stomach to carry out gastro-enterostomy, which should always be done no matter how small the lesion is. As has been said, results from this procedure have been satisfactory; the functional capacity is good, and the formation of an ulcer of the stomach later is a rare occurrence. The patient referred to in this report has been completely relieved, and at the time of the writing of this report he was on a trip to South America.

LESIONS OF THE KIDNEYS

Case VI.—Malignant adenoma of the kidney.—A married woman aged forty-eight years was admitted to the clinic August 15, 1929. The medical history was essentially negative. The chief complaint on admission was of recurring attacks of pain in the right upper part of the abdomen extending through to the back, associated with nausea and vomiting and requiring hypodermics for relief. She had had five attacks during the two years prior to admission. Her general health between attacks had remained good. There never had been any urinary symptoms, or any chills, fever or jaundice, and the nausea and vomiting were thought to be symptoms of trouble outside the gastro-intestinal tract.

The patient was well nourished. The blood pressure was systolic 174 and diastolic 88. There was a palpable mass in the region of the right kidney. The mass was rounded, somewhat tender, and movable. Roentgenograms of the thorax, kidneys, ureters, and bladder were negative. Cholecystograms disclosed a normally functioning gallbladder. The catheterized urine did not contain albumin or pus cells. The percentage of hemoglobin was 70; erythrocytes numbered 4,550,000 and leukocytes 7,300 in each cubic millimeter of blood. On cystoscopic examination, the function of each kidney was normal. A pyelogram of the right kidney gave evidence of median displacement of the pelvis and upper part of the ureter and elongation and narrowing of the middle calix, with a small, hook-shaped extension of the lower calix. There was a visible outline of a mass adjacent to both calices and extending below them (Fig. 3). Diagnosis of renal neoplasm was made.

Exploration through a lumbar incision, August 26, 1929, revealed a tumor in the lower pole of the right kidney, approximately 10 cm. in diameter. Right nephrectomy was done; the ureter was ligated and was dropped back into its place.

Examination of the removed kidney revealed a rounded, encapsulated tumor in the lower half of the kidney, measuring 10, 10, and 7 cm., in various diameters (Fig. 4). Microscopic examination revealed a low-grade carcinoma within an adenoma. The specimen weighed 435 gm.

Convalescence was uneventful. The patient was dismissed on the twenty-first postoperative day, with the wound healed, in good general condition.

FIG. 3 (Case VI).—Shadow of the soft tissue and the extensive deformity of the renal pelvis and calices.

Comment.—Adenoma of the kidney is common. It is most frequently found at necropsy, as the lesion ordinarily is too small to be recognized during life and usually it does not produce symptoms.

In the course of the last few years, cases of adenoma of the kidney have been reported by us, and a complete review was published recently by Kretschmer.

Most of the adenomas of the kidney that we have seen have been definitely benign; a few have been of sufficient size to produce symptoms. The case here reported is of particular interest because in the first place the lesion was of such a size that it could be felt easily and could be recognized as a tumor of the right kidney. The feel was more like that of a hypernephroma in a movable kidney and we rather suspected before operation that it might be a hypernephroma. The case also calls attention

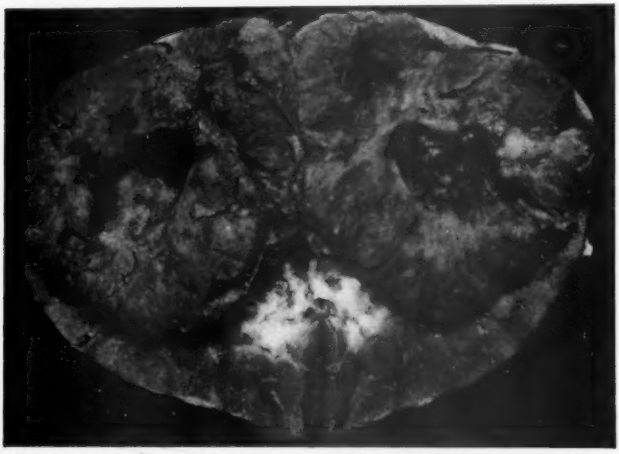

FIG. 4 (Case VI).—The kidney opened longitudinally showing the tumor involving the lower half of the kidney; microscopically this tumor proved to be carcinoma within an adenoma.

to the fact that adenoma of the kidney may develop into a large tumor and that the lesion may be malignant.

Case VII.—Large infected kidney, with hydronephrosis that probably was congenital.—A boy aged six years was registered at the clinic. His infancy and childhood, for the most part, had been normal. He had undergone tonsillectomy and adenoidectomy at the age of three years. Seven months previous to his admission to the clinic he had been ill with a sore throat, vague abdominal pains, and fever. During two weeks the fever had ranged between 101° and 104° F. The abdominal pain had become localized in the right side of the abdomen and a tender mass had appeared in the right upper quadrant. A diagnosis of appendiceal abscess had been made and

operation was performed. The appendix was said to have been normal, but a large fluctuating, cystic, retroperitoneal mass had been encountered. This had been drained of a considerable quantity of fluid that had looked like urine. The abdominal wound had healed promptly and the patient had made a good recovery and had remained in good health until two weeks before his admission to the clinic. At this time he had had a recurrence of fever and of pain in the right side of the abdomen. His mother had thought she could feel a mass in the right upper part of the abdomen.

The boy was well nourished. The entire right side of the abdomen, beneath a healed, lower right rectus scar, was held rigid on examination, but a definite mass was not palpable. The temperature was 100° F. on admission and ranged between 99.2° and 102° F. during the ten days' observation in the hospital. The urine, at times, was almost clear and at other times was loaded with pus. From both kidneys taken together there was 80 per cent return of phenolsulphonephthalein in two hours. Roentgenograms of the thorax, kidneys, ureters, and bladder gave negative results. A pyelogram of the right kidney showed that the ureter was filled in its lower two-thirds only, was irregular and was slightly dilated. There was a faint shadow in the upper part of the ureter, leading to a faint area of medium in the region of the right kidney. The urine from the left kidney was clear and the function of the kidney was normal. A diagnosis was made of a functionless, infected right kidney and hydronephrosis.

Exploration revealed a large infected kidney, with hydronephrosis and complete destruction of the kidney. The pelvis and calices were dilated and the cortex was thinned to a mere shell. The specimen weighed 200 gm. Nephrectomy was done.

Convalescence was uneventful. The patient was out of bed on the eighth day and went home on the fifteenth day, with the wound healed, in good general condition.

Comment.—Various theories have been advanced to explain unilateral hydronephrosis seen in infants and children. Most present-day authorities favor the belief that it is due to some mechanical obstruction caused by a congenital defect. Many cases have been reported in which anomalous vessels crossing the ureteropelvic juncture were the apparent cause of the obstruction. Others have demonstrated ureteral kinks, defective ureterovesical relationships, and cases in which the ureteropelvic juncture seemed badly situated for adequate drainage of the renal pelvis. The causative factor in many of these cases is not definitely found, even at operation. Some have explained these cases on the basis of congenital atony of the renal pelvis and ureter. They must not be confused with bilateral hydroureteral angularity with hydronephrosis, recently studied by

Hinman, in which both kidneys are affected and both ureters are lengthened, dilated, and tortuous.

The initial symptom is often tumor, which may be present even at birth, as in a case reported by Kakels, in which he removed a kidney, which contained more than 900 c.c. of urine, from a patient six weeks of age. In other cases the symptoms may go unnoticed until infection sets in, as in Case VII. In this case the first symptoms appeared at the age of five and a half years and were those of renal pelvic infection and a palpable tumor. Nephrectomy was the only rational treatment for the renal function had been completely destroyed.

At The Mayo Clinic, during the period of ten years ending January 1, 1929, operation was performed in 399 cases of hydronephrosis, of which eighteen (4.51 per cent) were in children aged less than sixteen years. During the same period there were 148 cases of hydropyonephrosis of which only two (1.35 per cent) were in children.

Case VIII.—Multiple cortical abscesses in a kidney already affected with chronic glomerulonephritis and renal tuberculosis.—A married woman aged twenty-three years had known that she had high blood pressure for eighteen months prior to her admission to the clinic. She had suffered with headaches and fatigue and had been unable to gain weight. Four months previous to her visit to the clinic, she had been in an automobile accident and had sustained an injury in the region of the left loin. The injury had seemed trivial at the time. Her local physician had examined her after the accident and found pus cells, but no blood, in the urine. Following the accident she had noticed occasional dull, aching pains in the region of the left kidney. Four weeks before admission she had begun to have chills and fever, recurring at intervals of one to three days. The chills had been severe and the temperature had risen at times to 106° F. She had lost weight and strength rapidly and the pain in the region of the left kidney had seemed worse. Frequent examination of the urine during the interim had failed to disclose more than an occasional pus cell.

On admission the patient weighed 80 pounds. There was definite pallor and marked weakness. The blood pressure was 150 systolic and 95 diastolic. The peripheral and retinal vessels were moderately sclerosed. General examination did not reveal anything further except slight tenderness in the left costovertebral angle. The concentration of hemoglobin was estimated at 56 per cent, erythrocytes numbered 4,020,000 and the number of leukocytes varied between 10,000 and 17,000 in each cubic millimeter of blood. The urine disclosed a moderate amount of albumin and an occasional pus cell. The concentration of blood urea was 102 mg. for each 100 c.c. of blood, and

the creatinine 4.4 mg. The return of phenolsulphonephthalein was 15 per cent in two hours. The patient was observed during a severe chill after admission, following which the temperature rose to 105.5° F. There were no localizing symptoms except slight pain in the left upper part of the abdomen. Blood culture gave negative results and bacilli of tuberculosis could not be found in the urine. A diagnosis of chronic glomerulonephritis with cortical abscess was made. Fluids given intravenously and medical treatment of the renal insufficiency did not have any effect, and operation was undertaken without delay.

The exploration of the kidney was carried out through a left lumbar incision. There was no perirenal infection, but the cortex was riddled with small abscess cysts of the type described by Brewer. Nephrectomy was done.

The kidney weighed 85 gm., and it was estimated that 95 per cent of it was destroyed. There were numerous small abscesses in the cortical portion of the kidney, ranging from microscopic size up to 4 mm. in diameter. There was a small region of tuberculosis in the lower pole of the kidney, measuring 5 mm. in diameter. The kidney also showed the typical gross and microscopic changes seen in chronic glomerulonephritis.

There was complete relief from the chills and fever. The blood urea rose as high as 168 mg. and the creatinine to 8.2 mg. in each 100 c.c. of blood. Physiologic solution of sodium chloride was given intravenously daily and the patient was given a diet low in protein. She improved steadily, gained weight, and left the hospital on the eighteenth postoperative day. At the time of dismissal the blood urea was 84 mg. In a recent letter she reported that she had felt fairly well since leaving the hospital and that she had remained free from chills and fever. She had been able to do her own housework but had had some headaches and fatigue, and she is probably still suffering from some degree of impairment of renal function.

Comment.—Brewer, more than twenty years ago, demonstrated clearly by experimental and clinical studies the hematogenous origin of cortical abscess of the kidney. He demonstrated the embolic origin of pyogenic organisms in the capillaries of the renal cortex, with the formation of small abscesses, which, if the patient does not succumb to the infection or if it is not treated surgically, spreads by extension-necrosis and terminates either by eroding into the renal pelvis, with the production of pyelonephritis, or by breaking through the cortex, forming a perinephritic abscess. He and others have emphasized the occurrence of such a complication in the course of the bacteremia associated with many of the infections, such as furuncles, carbuncles, paronychia, acute tonsillitis, typhoid fever, septicopyemia, and chronic foci in the teeth or tonsils. Brewer, Israel, W. J. Mayo,

and others have laid stress on the increased susceptibility to such infection of a kidney previously injured by direct trauma, the presence of stone, hydronephrosis, or other chronic disease. The affection is commonly unilateral or, if bilateral, the predominant lesion is unilateral. Surgical intervention offers the best and often the only means of cure. Nephrectomy is usually required, but certain of the milder cases have been successfully treated by incision and drainage, especially if the abscess is single.

In Case VIII the parent focus of infection was not definitely determined, but might have been an apical abscess at the root of a tooth. Two such abscesses in this case were diagnosed by dental roentgenogram. The kidney affected had been definitely exposed to direct trauma four months previously and was already the seat of chronic glomerulonephritis. There was, therefore, an excellent medium for the lodgment and growth of bacterial emboli. In this case the classic symptoms of recurring chills and fever, the slight, but definite pain in the region of the left kidney, the rapid decline in the patient's general condition, and the presence of definite tenderness in the left costovertebral angle were strongly suggestive of cortical abscess. The abnormal constituents of the urine were not marked; probably because none of the abscesses communicated with the renal pelvis. Because of the rapid decline in the condition of the patient, operation was promptly undertaken in spite of the extreme risk from the renal insufficiency. Our judgment was vindicated when the excised kidney was found to be almost completely destroyed and therefore functionless. Renal function had rested entirely with the opposite kidney and no doubt was considerably impaired by the presence of the infected kidney. The very small area of tuberculosis was found incidentally, and we could discover no evidence of any other focus of tuberculosis.

UNUSUAL TUMORS OF THE GASTRO-INTESTINAL TRACT

DONALD C. BALFOUR AND ARCHIBALD H. MCINDOE

REPORT OF CASES

Case I. Benign tumors of the stomach.—A man aged seventy-two years came to the clinic in September, 1929. Ten months previously he had begun to have an uneasy rumbling sensation in the right lower abdominal quadrant, particularly in the morning. This gradually became worse, but was not accompanied by pain. He began to lose weight (20 pounds), although his appetite remained fair and the bowels regular. Although the stools were occasionally very dark, definite melena was not present. Vomiting had occurred on three occasions. Increasing weakness was the most marked feature of the complaint.

The patient weighed 144 pounds. The abdomen was slightly resistant in the epigastrium, but masses could not be felt. Benign hypertrophy of the prostate gland, graded 2, and generalized arteriosclerosis, graded 2, were noted. There was 30 c.c. of residual urine. The erythrocytes numbered 3,650,000, and the leukocytes 6,300 for each cubic millimeter. The hemoglobin was 75 per cent. Analysis of the gastric content showed total acidity of 20, but free hydrochloric acid was absent in all fractions. A faint trace of blood was present. Roentgenologic examination of the stomach revealed a polypoid tumor at the pylorus, probably benign but possibly carcinomatous (Fig. 5).

Under ethylene anesthesia, the abdomen was explored and a mass was found on the posterior wall at the pyloric end of the stomach. On opening through the anterior wall, the mass proved to consist of two papillomas, about 1 cm. in diameter, attached to pedicles 3 cm. long, on the posterior wall just above the pylorus near the lesser curvature. The growths were excised with the cautery, the mucosal defect was repaired and the incision was closed transversely.

Pathologic examination of the tumors showed them to be benign pedunculated adenomatous polyps.

Benign tumors of the stomach are relatively rare. The actual proportion of benign tumors to malignant tumors and ulcerations is as 1 : 200. They form 1.3 per cent of all gastric tumors. A wide variety of histologic types was found in the twenty-seven cases reported from The Mayo Clinic by Eusterman and Senty, and in the series of fifty-eight cases reported

by Balfour and Henderson. Thus, adenomatous and fibro-adenomatous polyps, fibromas, myomas, hemangiomas, dermoid cysts, papillomas, and polypoid masses were all represented. Exclusive of gastric polyposis, pedunculated polyps, of which this case is an example, were found fourteen times. Nine were single and five were multiple. The highest number encountered in one case was twelve. They varied in size from 6 mm. in diameter to 8 cm. long and 2.5 cm. wide. Usually they were

FIG. 5.—Polypoid tumor of the pyloric end of the stomach.

situated at, or near, the pylorus or on the posterior wall, and occasionally, as in this instance, they were so placed that prolapse through the pylorus, with obstructive symptoms, resulted. This ball-valve action was illustrated by Gibson, who described a benign polyp just inside the pylorus which produced intermittent obstruction. Wade cited an example of intussusception of the stomach and duodenum caused by a benign pedunculated fibroma.

It is said that in 25 per cent of these cases symptoms of

pyloric obstruction are present. Hemorrhage from ulceration of the polyps is a more common complication and may be severe. In five of the fourteen cases it was marked and in three the condition of the blood was suggestive of pernicious anemia. In all of these cases the blood picture returned to normal after the removal of the polyps. Another interesting observation in all cases of polyps, uncomplicated by other gastric lesions and in the case reported here, is the absence of free hydrochloric acid from the gastric contents. This further tended to obscure the differential diagnosis of pernicious anemia, gastric carcinoma, and benign tumor. Usually, however, the tumors are relatively symptomless and when small and not eroded, not too near the pylorus, and not associated with other lesions, are rarely diagnosed clinically, unless by roentgenologic examination.

Roentgenologically the picture is more suggestive than diagnostic, and with the exception of gastric polyposis with characteristic mottling of the gastric shadow, differentiation of the type of tumor is not possible. Moore stated that in general benign tumors produce a circumscribed and punched-out filling defect, usually on the gastric walls, leaving the curvatures regular and pliant. Although the rugae are obliterated from the immediate area of the tumor, just as in inflammatory and malignant lesions, the rugae, surrounding the benign tumor, are more nearly normal in arrangement and distribution. Little disturbance in peristalsis is noted, nor is there any niche, incisura, or any other evidence of spasm.

The potentiality of these small adenomatous polyps for malignant change appears to parallel rather closely the same type of tumor in the colon and rectum (Lockhart-Mummery, Dukes and Saint). Thus, the pathologic report of one of these polyps, approximately 7 cm. in diameter, situated at the cardiac end of the stomach, was suggestive of malignant degeneration. Although the tumor was rather inaccessible it was removed by cautery amputation of the pedicle. Four months later exploration revealed an inoperable carcinoma of the cardiac end of the stomach, apparently originating at the site of the tumor.

Another interesting example of this relationship was noted

at necropsy. In the stomach was a large hard ulcerating mass 8 cm. in diameter, involving the pylorus and densely adherent to the pancreas. Two small polypoid tumors were also associated with the mass. The larger tumor, 1.5 cm. in diameter, was situated in the middle third of the posterior wall, and the smaller tumor, 1 cm. in diameter, was just within the cardiac orifice. Microscopically the pyloric tumor proved to be a colloid carcinoma. The polypoid tumor on the posterior wall was definitely adenocarcinomatous and was not connected with the pyloric mass, whereas the tumor at the cardiac end of the stomach was a benign adenomatous polyp. There was no way of determining whether the pyloric carcinoma had originated in a polyp, but it was quite certain that the malignant gastric polyp associated with it would have become a carcinomatous ulcer within a short time.

Case II. Secondary anemia associated with a malignant lesion of the small intestine.—The patient a man aged fifty-three years came to the clinic, April 5, 1929, because of marked weakness from gastro-intestinal hemorrhages which had enforced idleness on him for four years. He had had typhoid fever in 1898, and so-called gastric fever in 1900. His symptoms began in the winter of 1923, when he had noted epigastric pain coming on at night from 1.30 to 4.00 a.m., usually after he had eaten heavily. There was never any distress in the daytime. In August, 1924 he had had a severe gastro-intestinal hemorrhage associated with black, tarry stools. He was pale and weak for several weeks afterward. Roentgenographic studies of the gastro-intestinal tract were negative. The patient attempted to work after this, but had to stop at the end of three months because of weakness. Subsequent to the hemorrhage he began to have "sour stomach" in the late afternoon at irregular intervals. In August, 1925 he had a second hemorrhage and a third occurred a year later. Since that time there had been progressive weakness, pallor, and increasing distress. For three weeks he had been extremely weak, and thought there had been some soreness of the tongue and numbness in the left hand. There had been a loss of weight of 30 to 35 pounds in five years.

The patient was too weak for examination in the clinic and was sent at once to hospital. He was emaciated, weak, and pale. An epigastric mass was not felt, and examination of the central nervous system was negative. There was no evidence of lymphatic metastasis. The hemoglobin was 32 per cent; the erythrocytes numbered 3,320,000, leukocytes 8,000, and the platelets 240,000 in each cubic millimeter; the blood picture was that of secondary anemia. There was blood in the stools on two occasions. Roentgenograms of the stomach, esophagus, and colon were negative. Gastric analysis revealed achlorhydria. The inference was that there was a tumor of the small bowel.

April 27 an exploratory operation was performed and a tumor was removed from the upper part of the jejunum. The growth was annular, measured 6 by 3 cm., and was ulcerating with raised, thickened, hard, irregular edges. The mesenteric lymph nodes were involved. Microscopic study showed a very cellular carcinoma.

The patient was dismissed from the hospital on the twenty-fourth day, greatly improved. On the second day after operation the patient was very weak and pale; the pulse began to rise and was poor in quality. A transfusion of 400 c.c. of blood was given and he improved immediately. Owing to lowered resistance, pneumonia developed on the seventh day and ran a course of low fever and slow resolution. The hemoglobin on the day of dismissal was 50 per cent and the patient's strength and weight improved.

The purpose of presenting this case is to draw attention to one of the possible explanations for obscure secondary anemia. This is not the first case of this type which has been seen in the clinic; there are records of fifty cases of malignant lesions of the small intestine. Most of these, however, have been secondary to lesions in the colon or in other regions of the abdomen. Primary carcinoma of the small intestine is rare. It is still more rare that the only symptom presented is anemia, and the anemia is particularly remarkable in this case because the hemorrhages extended over such a long period of time. In a review of the history of the case, it is found there were gastro-intestinal hemorrhages in 1925, 1926, and 1927. It is unusual, too, that a tumor of such size should not be associated with symptoms of obstruction. In a recent case, in which operation was performed, severe secondary anemia occurred, but there was also intermittent obstruction which made diagnosis possible. The possibility that the lesion may be associated with duodenal ulcer, as in another case in which operation was performed, is a most important point. In such a case the assumption could be that the ulcer had been responsible for the bleeding, and the tumor, if it were situated at any considerable distance distally in the jejunum, could easily be overlooked. The significant point in this case, therefore, is that when a patient has had repeated gastro-intestinal hemorrhages, but the results of examination are negative, operation should be advised, and the possibility of a carcinoma of the small intestine should be kept in mind.

Case III. Pellagra after jejunostomy for irremovable lesion of the fundus of the stomach.—The patient, a woman aged forty-six years, came to the clinic in June, 1929, with the following history. Four months previously after a dietetic indiscretion she took calomel and Epsom salts; this was followed by black stools for three to four days. Three months later she took the same cathartic and the following morning was awakened suddenly by a feeling of marked faintness, weakness, thirst, and pallor. This was followed by emesis of a small amount of bright red blood, and for the next three days tarry stools. Transfusions were given with marked improvement. Except for recent slight nausea in the morning, she had never had indigestion, vomiting, or pain. She had not lost weight.

FIG. 6.—Large, apparently malignant and inoperable lesion of the fundus.

The patient proved to be in good general condition, except for moderate secondary anemia. The systolic blood pressure was 100 and the diastolic 48, measured in millimeters of mercury. Urinalysis was negative. The hemoglobin was 50 per cent; the erythrocytes numbered 4,110,000. Analysis of the gastric contents showed total acidity of 40, free hydrochloric acid of 24, and no retention. Roentgenologic examination of the stomach revealed a large, ulcerating lesion high in the fundus of the stomach, apparently malignant and irremovable (Fig. 6). Owing to the fact that the gastric acids were normal and the patient's general condition was excellent, exploration was advised.

At operation an ulcerating lesion of the fundus was found, as large as the palm of the hand and surrounded by a mass about 8 cm. in diameter. The

lesion was considered carcinoma, although the possibility of a benign growth was recognized. It seemed best, therefore, to treat it as the latter, and a Witzel type of jejunostomy was performed, a number 20 catheter being used. General exploration did not show obvious metastasis. The postoperative convalescence was uneventful and the patient was sent home under dietary management and with instructions as to administration of fluids and nourishment through the jejunostomy tube.

Three months later the patient returned. Ten weeks after dismissal, during which time she had experienced increasing difficulty in getting sufficient food through the rather small jejunostomy tube, she noticed the rapid onset of a burning sensation and soreness of the mouth and tongue.

FIG. 7.—Regression in size of lesion five months after jejunostomy.

The tongue was beefy red. Both hands were rough, and the knuckles were fissured, characteristic of secondary pellagra. Gastric analysis at this time revealed total acidity of 20 and free hydrochloric acid of 6. Roentgenologic examination of the stomach did not show change in the size of the lesion. The patient was placed on a strict ulcer diet, containing brewers' yeast, fruit juice, and beef juice; the feedings were given through the jejunostomy tube and were supplemented by cautious oral administration. Within a week the patient showed marked improvement; the glossitis, rectal pain, and dermatitis were disappearing rapidly.

Two months later (five months after the operation) the patient returned, feeling very well, with complete disappearance of any signs of malnutrition. She had gained 15 pounds. At this time roentgenograms of the stomach

revealed the lesion to be only about 1 cm. in diameter, with marked shallowing of the crater and increased flexibility of the gastric walls (Fig. 7). The probability of the benign nature of the lesion seemed to be established.

This case illustrates several important principles in dealing with irremovable lesions of the stomach, whether they are benign or malignant. There are in general four procedures applicable, when after careful inspection attempts at removal should not be made: (1) Posterior gastro-enterostomy, (2) anterior gastro-enterostomy, (3) jejunostomy, and (4) partial gastric exclusion. For irremovable lesions near the pylorus and definitely on the gastric side, partial gastric exclusion by division of the stomach well above the lesion, closure of the pyloric stump, and restoration of gastro-intestinal continuity by anterior or posterior end-to-side union of the upper segment and the jejunum, is a most useful type of operation. The relief of symptoms in such cases is complete and if the lesion is not malignant, the relief is usually permanent. If the lesion is malignant the procedure offers almost certain protection against obstruction, with the further possibility of later removal of the pyloric segment along with the lesion, as a two-stage maneuver. For irremovable lesions of the body of the stomach, usually on the posterior wall, anterior gastro-enterostomy is the method of choice since satisfactory posterior anastomosis is almost certain to be difficult. Here, too, subsidence of inflammatory changes in and about the lesion may make secondary resection possible. When the tumor is situated in the fundus the choice lies between gastro-enterostomy and jejunostomy. When carcinoma is certain, the former is preferable as an ample amount of stomach can be mobilized below the lesion to permit satisfactory anastomosis. Even though it has been stated that gastro-enterostomy should be performed proximal to the lesion, considerable relief may be given when this is not possible. In younger patients and when it appears probable that the lesion is benign, jejunostomy offers a good prospect for healing. In a number of cases complete disappearance of the ulcer has been observed following the rest afforded the stomach by a few weeks of feeding through a jejunostomy tube. Periodic roentgenologic examination will de-

termine the improvement of the lesion and the optimal time for the removal of the tube. In this instance clinical and roentgenologic data were strongly in favor of carcinoma, but without exploration there appeared sufficient evidence to suggest the possible inflammatory nature of the mass. Accordingly, jejunostomy was performed and was followed by marked reduction in the size of the lesion, on subsequent roentgenologic examination. The development of avitaminosis or secondary pellagra during the period of feeding through the tube can be traced to the fact that the tube was too small in caliber to permit satisfactory handling by the patient herself. She stated that to maintain its patency, the food had to be strained through several thicknesses of gauze and was so dilute that little was left but the water and the odor. Within three months symmetric dermatitis, glossitis, and diarrhea developed, characteristic of secondary pellagra. The patient was, however, promptly relieved by the administration of suitable foods, containing the necessary vitamin B. Striking clinical improvement then occurred.

Roth, in 1916, and Bryan, in 1919, reported the first instances of pellagra, secondary to lesions of the stomach interfering with nutrition, and Bender, in 1925, called attention to it again. O'Leary reviewed five similar cases in the clinic, and concluded that the obstructive lesion plays essentially a mechanical part in that it prevents the ingestion of sufficient food or food containing enough vitamins. He found it in cases in which there was malfunctioning gastro-enteric stoma, gastric ulcer, stricture of the esophagus, or carcinoma of the stomach, bowel or esophagus. Rapid disappearance of the signs of the disease, following removal or relief of the obstruction, was the rule. Such cases strongly support Goldberger's conception of dietetic deficiency as the essential etiologic factor in pellagra.

INTRACAPSULAR FRACTURE OF THE HIP; SUBACUTE OSTEOMYELITIS AND ENDOTHELIOMA OF THE LOWER END OF THE FEMUR; SLIPPING EPIPHYSIS OF HEAD OF LEFT FEMUR; RECONSTRUCTION SHELF OPERATION FOR CONGENITAL DISLOCATION OF THE LEFT HIP; OLD TRAUMATIC DISLOCATION OF THE LEFT HIP

MELVIN S. HENDERSON

INTRACAPSULAR FRACTURE OF THE HIP

Case I.—A woman aged sixty-four years, living on a farm, was admitted to hospital November 20, 1929. She stated that at 9.00 p.m. of the day

FIG. 8 (Case I).—Recent fracture of neck of right femur.

before, while dancing, she had been knocked down by another couple. She had been helped to her feet and carried to a chair.

Roentgenograms disclosed an intracapsular fracture of the neck of the right femur (Fig. 8). There was shortening of the leg and pain on movement of the right hip. Under anesthesia, on the fracture table, the impaction was broken up and the leg was brought down to equal length with the other leg, rotated inward, and abducted. A roentgenogram was then taken and developed before a cast was applied (Fig. 9). Good apposition with the head in valgus position on the neck was shown. A double spica cast was applied, extending from the thorax to the toes on the right side. The right hip was abducted and the foot inverted. The cast extended to the knee on

FIG. 9 (Case I).—After reduction; overcorrection of the deformity; valgus position.

the opposite side, and there were bars of reinforced plaster between the knees to maintain the abduction.

Recent fractures of the neck of the femur are as amenable to treatment as fractures elsewhere. The impaction should be broken up under anesthesia and the deformity corrected just as one would do with a Colles' fracture of the wrist, or a Potts' fracture of the ankle. By maintaining a valgus position, it has been my experience that union takes place more rapidly even

than when the perfect anatomic reposition is obtained. Following any fracture there may be slight atrophy and absorption of the rough fractured surfaces of the fragments and thus the line of contact of each fragment may atrophy just sufficiently to allow slipping. With the valgus position, as shown in Figure 9, if some slipping does occur, the position assumed is more nearly anatomic.

It will be at least three months before this patient is allowed to walk, and six months before any weight bearing is permitted. Roentgenograms will be taken at intervals, and when they give evidence of firm bony union, increased activities will be permitted. The earliest, firm bony union I have seen in a fracture of the neck of the femur of this type occurred in three months. It is best to anticipate a six months' disability, without weight bearing in that time.

SUBACUTE OSTEOMYELITIS AND ENDOTHELIOMA OF THE LOWER END OF THE FEMUR

Case II.—A man aged twenty-two years, a salesman, came to The Mayo Clinic July 5, 1929 with a history that about one year before there had occurred, without previous trauma, some swelling and pain in the lower end of the left femur, which had laid him up for two or three days. Similar attacks had occurred nine and six months before examination at the clinic. The present attack really had begun three months previous to my seeing him, and when he came to the clinic there was swelling and pain which had been relieved to a certain extent by taking acetylsalicylic acid and by heat.

The patient was 5 feet 9 inches in height and weighed 147 pounds. He said that he had lost about 12 pounds in the last eight months. The lower third of the left thigh was slightly enlarged and tender on the inner side. A definite tumor was not palpable. The Wassermann reaction of the blood was negative, and roentgenogram of the thorax gave negative results. A roentgenogram gave evidence of tumor in the lower third of the left femur, with thickening of the periosteal layer, a portion of which was in leaflike formation (like an onion). There was an irregular medullary shadow which did not have a really definite line of demarcation (Fig. 10). A diagnosis of bone tumor was made, probably endothelioma, and operation for the purpose of exploration was advised. The patient agreed that if at exploration the clinical diagnosis of endothelioma should be proved to be correct, amputation should be done. He was running a temperature of 99° F. and leukocytes numbered 13,300 for each cubic millimeter of blood.

July 9, an incision was made on the outer side of the lower end of the thigh. The periosteum was found to be much thickened, but not very vascular. The chisel was introduced into the bone, and as it went through the

somewhat osteoporotic cortex, pus with the smell of that produced by colon bacilli was evacuated. Sequestrum was not found. The tissue removed was sent immediately to the laboratory for diagnosis, and a report was returned of chronic inflammatory obliterated endarteritis and periarteritis. We who were operating were much relieved and felt that our preoperative diagnosis of endothelioma was wrong.

Convalescence was not very satisfactory. Considerable local reaction occurred in the soft tissues; they became infected, much edema developed, and thick, rather tenacious pus drained. Such a condition, however, frequently follows the release into the soft tissues of pus that long has been

FIG. 10 (Case II).—Rarefied mesial portion of femur with thickening and proliferation of the periosteal layers, strongly suggesting endothelioma.

locked up in bone, and probably is due to the fact that the soft tissues have not developed any resistance or immunity to the particular organism present.

The patient returned to the clinic in the latter part of August on account of increased discomfort, with swelling and inflammation. Warm dressings were applied, but his progress was unsatisfactory. Drainage continued, and occasional sharp pains were felt. About the latter part of November a well marked swelling appeared on the inner side of the lower end of the femur and an exploratory tapping was made, but no pus was obtained. The patient went home for a week or two at Thanksgiving time and then came back with the swelling still more noticeable (Fig. 11). A roentgenogram gave a shadow

even more typical of endothelioma than the first one. December 3 this tumor was subjected to exploration and a large mass of organized vascular tissue was excised, which proved to be ăn endothelioma. The wound was packed to control bleeding, for consent to amputation had not yet been obtained. December 4 amputation was performed. Roentgenograms of the thorax, taken previous to the amputation, had showed the lungs to be clear.

This case serves to emphasize the difficulties in the diagnosis of bone tumors, even when the tumor is subjected to exploration

FIG. 11 (Case II).—Same as Fig. 10 three months later; the soft tissue tumor which proved to be endothelioma is bulging into the soft parts.

and the tissue is examined in the laboratory. Since there had been a suspicion that the tumor was an endothelioma, consent for amputation was obtained at the time of the first operation, but at operation pus was encountered and it seemed probable that the tumor was not an endothelioma. The long convalescence was attributed to the type of infection present and the liberation of pus into tissues in which immunity had not devel-

oped. In three months, however, a definite tumor presented on the mesial side of the thigh; the patient had lost weight and had a bad color. At operation an endothelioma was found. Whether the endothelioma existed at the time of the original operation or developed later is, of course, a question that might be argued, but I am of the opinion that the endothelioma existed from the first, and that I was lulled into a sense of security by the negative laboratory report and the finding of pus at operation. The prognosis in this case, of course, is poor, as endotheliomas of this type are malignant and usually result in death by metastasis. I shall advise deep roentgen-ray treatment of the regions of the proximal lymph nodes, although, as endotheliomas spread by the vascular route rather than by the lymphatic system, the usefulness of the treatment is doubtful. This type of tumor, when considered inoperable, often shrinks almost to invisibility under treatment by roentgen rays, but in my experience all patients die of metastasis later.

SLIPPING EPIPHYSIS OF HEAD OF LEFT FEMUR

Case III.—A boy aged fifteen years, 5 feet 8 inches tall, weighing 123 pounds, was examined in the clinic July 22, 1929. About eight months previously he had injured the left hip while playing football, but had thought little of it at the time and had not been laid up. In January, 1929 he again had injured the left hip while playing leap-frog. About three months before examination at the clinic he had gone through an attack of influenza and had become run down. He had been brought in because of a limp and a pain in the left hip. Examination disclosed a well nourished boy, large for his age. Motion in the left hip, particularly abduction, was limited, and the leg went into eversion on flexion of the hip. He walked with a slight limp. Roentgenograms (Figs. 12, 13) disclosed partial separation of the epiphysis of the neck of the femur, a varus deformity resulting. Because it was believed that this condition had existed for some time and that manipulation would not be likely to restore the epiphysis to proper position, an open operation was performed July 30. The hip was exposed by a modified Smith-Petersen incision and the capsule was opened. The capsule was found to be filled with dark, bloody fluid that was under pressure. It was with some difficulty that the fragments were separated by chiseling and were brought into what was judged to be good position. A beef-bone screw was placed through the neck into the head of the bone. A roentgenogram taken at once disclosed excellent position, which was maintained by a double spica cast. Figure 13 shows the result five months later. The patient is walking without any discomfort. There is shortening of approximately 2 cm., but function is excellent.

More commonly than in others slipping epiphysis occurs in boys and girls of the husky, robust type, who are large for their age, and often overweight. Trauma is the immediate cause. If diagnosis is made early, manipulation and maintenance of abduction, with inversion of the foot, may give good reposition of the fragments, but if the condition has existed for some time, as in this case, manipulative efforts are of no use. If allowed to go unreduced a large mushroom-shaped upper end of the femur

FIG. 12 (Case III).—Partial separation of head of left femur in a boy aged fifteen years.

will result, often with marked eversion of the foot and leg. Later in life, arthritic changes will further disable the patient. Hence, anatomic reposition is important. In younger children Legg's disease, or flathead, is encountered, whereas at puberty and thereabouts, this type of slipping epiphysis is the more common. The shortening of 2 cm. cannot be accounted for by anything seen in the roentgenogram. I believe it likely that inactivity of the growing centers in this region has occurred

for more than a year, and that this best explains the shortening. It will probably be compensated for during the next few years.

FIG. 13 (Case III).—Five months after reposition of the epiphysis on the neck of the femur; the beef-bone screw has been almost completely absorbed.

RECONSTRUCTION SHELF OPERATION FOR CONGENITAL DISLOCATION OF THE LEFT HIP

Case IV.—The patient, a well developed healthy looking girl, now aged thirteen years, first came to the clinic November 6, 1919, when she was but three years old. An attempt was made to reduce a congenital dislocation of the left hip, but roentgenograms taken the next day showed the head of the femur to be above the acetabulum. A few days later the hip was again manipulated and all clinical signs indicated that reduction had been accomplished; there was a full feeling anteriorly, beneath the femoral artery in the groin and tightening of the hamstrings when the leg was up in the frog position. Roentgenograms gave evidence of satisfactory and apparently complete reduction. The cast was changed at intervals during the next year, and each time that roentgenograms were taken the hip was shown to be in place. The child was examined from time to time; the last time was October 3, 1921, two years after the reduction. My notes made at that time state that the result was excellent. No Trendelenburg sign was present, both legs

FIG. 14 (Case IV).—Two years after reduction of congenital dislocation of left hip; the foot is inverted; the head of the femur is in the acetabulum, although the latter is shallow.

FIG. 15 (Case IV).—Same as Fig. 14 with the leg everted. The precarious position of the head in its relation to the shallow acetabulum is evident.

were of equal length and the child walked without any limp. The only abnormality noted was that there was a slight tendency to turn the foot

outward, but the child could easily overcome this when she was reminded of it. Roentgenograms taken at that time showed the head of the femur well in place, when the leg was inverted (Fig. 14), but in rather a precarious position when everted (Fig. 15). The acetabulum was shallow.

In spite of the request to have the patient report occasionally, she was not brought back until October, 1929, eight years later. For some time the parents had noted a limp that had been getting worse, and the child, now thirteen years of age, had complained that she tired easily if she walked far. Roentgenograms (Fig. 16) disclosed a congenital dislocation of the left hip

FIG. 16 (Case IV).—Congenital dislocation ten years after reduction. The head of the femur rests in the false acetabulum; the true acetabulum is obliterated.

with 0.5 cm. of shortening of the leg and obliteration of the normal acetabulum. There was a positive Trendelenburg sign and the patient walked with a limp. Since the normal socket was completely obliterated, the problem was, in some way, to provide means of skeletal weight bearing. It has been my experience that by turning down a shelf of bone from the ilium, so that the head of the femur will rest against it and thus transmit weight through the pelvic wall, good function will result. Accordingly, this was done November 18 (Fig. 17). A Smith-Petersen incision was employed, reflecting the muscular attachment from the iliac wall by taking along with the muscular attachment to the crest a flake of bone from the iliac crest. Thus when the wound was

to be closed it would be easy to get a good strong suture to pull the upper part of the gluteal muscle and this flake of bone against the iliac crest. By introducing a curved hip chisel just above the false acetabulum, a strong piece of bone was turned down over the head of the femur; the gap thus produced was kept open by packing in it many chips of bone obtained from the iliac wall. The wound was then closed, and a plaster-of-paris cast was applied which extended from the thorax to the toes on the left side and to the knee on the right side.

FIG. 17 (Case IV).—The shelf of bone is turned down from the iliac wall to give skeletal support for weight bearing.

It is estimated that 75 per cent of the closed reductions for unilateral congenital dislocation of the hip are successful, and that 50 per cent of cases of bilateral dislocation are successful. By that is not meant that all patients who obtain good results have joints which look normal in the roentgenogram. It is meant that they have satisfactory skeletal support, that the typical, waddling gait is done away with in cases of double dislocation and that the limp disappears in the unilateral cases. The Trendelenburg sign is obliterated in both. It is surprising

that normal function will result, even though the head of the femur is markedly distorted. Skeletal support of the head of the femur is what is necessary, and when this is provided, even though shortening is not obliterated, the gait so characteristic of patients with fibrous union or with dislocated hips, in cases in which the head has no support on the bone, is done away with. There is every reason to expect a satisfactory result in this case.

The etiology of congenital dislocation of the hip is doubtful. It is commoner in some localities and in some races than in others. For example, a great number of cases are to be seen in the clinics of Putti at Bologna and of Galeazzi at Milan. However, I know of no statistics concerning the point. For some unknown reason the condition seems more prone to occur in the otherwise healthy and robust population inhabiting the plains of northern Italy. Many large orthopedic clinics in the United States have very few cases.

It is probable that intensive follow-up of cases of congenital dislocation of the hip would lower the aforementioned generally accepted proportion of good results. In this case, for example, two years after operation it was thought that the result was successful. Some surgeons, such as H. P. Galloway, of Winnipeg, and the late Harry Sherman, of San Francisco, have advocated routine treatment by open operation in all cases. Evidently they were dissatisfied with their results by the closed method; figures have not been presented that would prove that open reduction in cases of congenital dislocation of the hip gives any better results than have been obtained with the closed methods. Most surgeons reserve the open method for application in cases in which the closed method has failed, but this is clearly unfair to the operative procedure.

OLD TRAUMATIC DISLOCATION OF THE LEFT HIP

Case V.—A man aged forty-three years, a railroad storekeeper, was examined at The Mayo Clinic August 2, 1929. July 1, 1928 he had cranked his car while it was in gear; the car had started and had caught him with the hip flexed so that his knee rested against the radiator and his back against a wall. He had been taken to a physician's office immediately, where roentgen-

grams had showed fracture dislocation of the hip. He had been immediately placed in bed in a hospital with a Buck's extension apparatus applied. The next day a cast had been applied, extending from the costal margin to the toes on the left side and to the knee on the right side. This had been left on for eight weeks, when the patient had been allowed to sit in a chair for about thirty days. Following this period he had used crutches, and had continued to do so up to the time of examination at the clinic a year after the accident.

When the patient was examined at the clinic he had no particular pain, and tenderness was of variable degree. When he was standing he could raise

FIG. 18 (Case V).—Upward and backward displacement of head of left femur and fracture of the acetabulum.

and flex the left leg, but when sitting, further flexion was impossible. The patient weighed 215 pounds. The left leg was 8 cm. shorter than the right, and was held inverted with the hip partially flexed. He could not flex the left leg on the trunk beyond a right angle and he could not walk without crutches. Roentgenogram (Fig. 18) disclosed an upward and backward displacement of the hip; the head of the femur rested posteriorly, high on the ilium. Evidently, also, there had been a fracture of the superior and posterior rim of the acetabulum. An open operation was advised, but it was explained to the patient that the head of the femur probably could not be reduced and placed in the socket, and that if this could not be done some sort of skeletal

support would be provided, for example, a Whitman reconstruction operation or construction of a new acetabulum. Accordingly, August 6, 1929 on the fracture table, the hip was exposed by a modified Smith-Petersen incision. With a Murphy reamer, such as is used for arthroplasty, a new acetabulum was made a little higher than the old one but on the same plane. It was with considerable difficulty that the head of the femur could be brought far enough forward to place it in its new acetabulum, but this was finally accomplished. The leg was held in abduction and a plaster-of-paris cast was applied, which extended from the thorax to the toes on the left side and to the knee on the

FIG. 19 (Case V).—Same as Fig. 18 four months after operation. There is an excellent new acetabulum to give bony support.

right side, with the foot in the upright position. The cast was removed September 20; the wound was found to be well healed, and a single spica cast was applied, extending to the left knee, holding the hip in abduction. Convalescence was normal, and the patient was allowed to go home, October 1, seven weeks after operation. He returned in the first part of December and my note, made December 4 four months after operation, was as follows: "Roentgenograms show excellent new acetabulum (Fig. 19). Motion is fair, with flexion to 150 or 140 degrees. He may go without his cast and use crutches for a month or two. He should have an excellent result as skeletal support is provided."

When dislocation of a hip has existed for any length of time, it is exceedingly difficult to reduce it. Even if the head of the femur could be brought down and placed within the acetabulum, a stiff hip probably would result, and it is better to accept moderate shortening and retain motion. The shortening can be compensated for by elevation of the heel of the shoe on the affected side, and the patient will get along very well. The shortening in this case was only about 3 cm., whereas previous to operation it was 8 cm.

VOLKMANN'S ISCHEMIC CONTRACTURE; BILATERAL CONGENITAL DISLOCATION OF THE HIPS; IRREDUCIBLE FRACTURE OF THE MALLEOLI OF THE ANKLE TREATED BY OPEN REDUCTION AND BEEF-BONE SCREWS; BONE GRAFTING FOR DELAYED UNION FOLLOWING OSTEOTOMY AND THE USE OF A LANE PLATE; TUBERCULOSIS OF THE HIP COMPLICATED BY PULMONARY TUBERCULOSIS, TREATED BY OSTEOTOMY AND ARTHRODESIS

HENRY W. MEYERDING

VOLKMANN'S ISCHEMIC CONTRACTURE

Case I.—A student aged nineteen years complained of marked flexion deformity of the left hand and inability to use the fingers. Ten years previously he had sustained a simple fracture of the left radius and ulna. His physician immediately had reduced the fracture and had applied anterior and posterior splints. For three days and nights the patient had suffered terrific pain and swelling, but the bandages had not been loosened until the end of the third day. A sore had developed on the anterior surface of the forearm, near the ulnar border, and at the end of six weeks, when the splints finally had been removed, he had not been able to straighten the fingers. Roentgenograms then had given evidence of malunion and operation had been advised. Two operations had been performed, respectively, eight and fourteen weeks after the original fracture, and good union had been obtained. During the years that followed there had been no pain or discomfort, but the forearm had grown more and more deformed and function had not improved. The patient was anxious to have the disfiguring deformity corrected.

Examination disclosed typical contracture deformity of Volkmann involving the left arm. There were scars which pressure sores evidently had produced, and the flexor muscles were ropelike, producing clawlike contractures of the wrist and the fingers. Owing to the ten years' duration of the condition, and to lack of normal stimuli, growth had been retarded, and the left forearm was 5 cm. shorter than the right. The circumference of the left arm, in comparison with the right, was 2.5 cm. less below the elbow, and 1.75 cm. less above the elbow. The wrist could not be extended, even with the fingers flexed, because of contracted capsules, and so forth (Fig. 20). The spinal column appeared prominent over the tenth thoracic vertebra and roentgenograms disclosed evidence of what was apparently an old fracture. The Wassermann reaction on the blood and urinalysis gave negative results.

The roentgenographic appearance of the thorax and of the left forearm were negative.

Operation was performed to correct the deformity and in the hope of causing some increase in function. Force exerted under anesthesia was of no avail, and our experience had shown it to be harmful if too much force was applied. Therefore, working through a long incision which extended well up from the wrist all flexor tendons were lengthened and capsulotomy was performed at the wrist. Then force was applied to extend the wrist and fingers, the wound was sutured, and a long splint was applied from finger tips to elbow. A sling was applied to support the arm at right angles; on the second

FIG. 20.—Volkmann's ischemic contracture of ten years' duration before operation.

day the patient was out of bed; and on the fifth day he was dismissed from hospital. There was little if any pain after operation. The stitches were removed at the end of two weeks and massage and training of the muscles were begun. At the end of ten weeks the patient had some power of flexion and could hold a ball 7.5 cm. in diameter. He was well pleased with the correction of the disfiguring deformity (Fig. 21). He was urged to continue physiotherapy at school and to return in a year.

The treatment of fractures should relieve pain, and should not produce days or even hours of intense suffering. There is

no need to give narcotics, except in rare instances when the fracture is reduced immediately, as in this case. Great swelling and pain are nature's warning that circulation is impaired, and unless steps are taken immediately permanent injury may result. Certainly cold, blue, swollen, damp extremities, in which the pulse is absent, or almost absent, indicate injury to soft tissues to be more significant than reduction of the fracture. Of what value was it to the patient that his bones were aligned when

FIG. 21.—Same case as shown in Fig. 20 ten weeks after operation.

muscles, blood vessels, and nerves were crushed so that function was practically destroyed? It is better to leave the fractures alone and to treat the soft tissue if swelling has occurred; later, in possibly a week or ten days, the fracture may be reduced. In the case cited the injury had occurred ten years previously and deformity was becoming more marked at the time the patient came to the clinic. Conservative treatment is of little benefit in this type of case, and our experience led us to operate

as the only means of correcting the deformity and improving the function.

In early cases gradual stretching, after the method of Sir Robert Jones, is excellent treatment. In this method the phalanges are splinted straight; then gradually the metacarpophalangeal joints and, lastly, the wrist are extended. Various types of splints permit this correction. Massage and heat at regular intervals are commonly used at the same time. Care, exerted by padding well and avoiding constriction, must be taken to prevent sloughs from pressure during this treatment.

In my series of 128 cases of ischemic contracture, 70 per cent were in males and 30 per cent in females; 67 per cent were in patients less than thirty years of age, and 33 per cent in patients more than thirty years of age. Fractures at the elbow are more common in males, probably due to their greater activity. The majority of the fractures associated with the contracture are at the lower end of the humerus. In about 5 per cent of the patients there was no evidence of fracture at the time of examination.

The upper extremities were involved in more than 90 per cent of the cases. In conclusion, it is well to remember that Volkmann's ischemic contracture may result from injury in cases in which bandage, splints, or plaster casts have not been used. This is an important medicolegal fact.

BILATERAL CONGENITAL DISLOCATION OF THE HIPS

Case II.—Thirteen years ago, a girl aged four years was brought to the clinic for consultation because of an unnatural gait. When the child was eighteen months old the mother had noticed a waddling, peculiar gait and had consulted an orthopedic surgeon who had made a diagnosis of bilateral congenital dislocation of the hips. However, operation was deferred and no treatment was carried out at that time.

Examination disclosed a typical waddling gait with upward displacement of both hips, and deformity. Roentgenograms gave evidence that both femoral heads were well above shallow acetabula; the epiphyses seemed to be fairly well developed (Fig. 22). The prognosis appeared unsatisfactory because of the shallow acetabula. The parents were advised to have an operation done, but were told that it was questionable whether permanent correction would be accomplished.

At that time, thirteen years ago, I manipulated both hips and placed

them in a double spica cast in frog position. Roentgenograms gave evidence that the hips apparently were in good position, and the child was dismissed on the seventh day to return home. She was brought back to the clinic at intervals of three months for change of casts, and each time the hips were lowered 15 degrees and double spica casts were reapplied. Roentgenograms showed evidence of good position on each visit, and at the end of ten months the patient was dismissed without a cast; the examination clinically and by roentgenologic methods, indicated satisfactory position. A year after the operation the patient again was examined and the position was deemed satisfactory. The parents reported that the child was getting along well, that no further deformity had developed, and that the condition was considered cured. In response to an inquiry sent out sixteen months after operation, the report was rendered that the patient was doing very well and

FIG. 22.—Bilateral congenital dislocation of the hips in a girl aged four years.

was walking apparently normally. The legs had been measured by the family physician and had been found to be of equal length. Ten years later, on inquiry, it was learned that some lameness was apparent. Roentgenograms indicated that the right hip was in perfect position, whereas the left had a very shallow socket and tended to move upward.

More recent experience has shown that excellent results can be obtained in stabilizing hips which are dislocated for long periods of time by making a shelf of bone on which the femoral head can rest. This operation is useful in old, unreduced congenitally dislocated hips, as well as in those in which the acetabulum is so shallow that dislocation occurs after reduction.

I have observed that late dislocation occurs after months of apparent reduction and care at the hands of excellent orthopedists. The value of careful follow-up observation is generally recognized, but at times it is difficult to accomplish, especially when the patient lives at a distance of hundreds of miles, and in a pioneer country. In this patient I believe a shelf of bone produced by turning down a section of ilium or by a graft from the tibia, would have prevented recurring dislocations. Should opportunity arise and the patient return, the making of a shelf of bone above the head of the femur will be indicated, so as to prevent further displacement and to permit formation of a new acetabulum.

Case III. Irreducible fracture of the malleoli of the ankle treated by open reduction and beef-bone screws.—A woman aged twenty-two years was thrown from an automobile in a head-on collision in August, 1925, injuring the left foot. She was taken to a nearby city where the attending physician took roentgenograms and applied splints for "fractures of both bones of the ankle." She returned home and on the same day consulted an orthopedist, who, after further roentgenograms of the malleoli, advised an attempt to improve the position of the fracture. He immediately gave an anesthetic and manipulated the ankle, putting the leg in a plaster cast with the foot at right angles and in slight varus. Subsequent examinations and roentgenograms failed to show satisfactory position, and a week later the patient again was anesthetized, the foot manipulated into extreme varus position, and a new cast applied. Four days later further manipulation was attempted, since the position of the astragalus did not appear to be satisfactory, and an attempt was made to force it inward. Further roentgenograms showed the position unimproved and the patient was brought to the clinic.

A study of the roentgenogram showed that when the position of the external malleolus seemed good, the internal malleolus was shoved too far inward. Therefore, the consulting surgeon felt that it would be best to treat the fracture by open reduction and to apply beef-bone screws to hold the malleolus on the inner side, firmly in position (Fig. 23). A plaster cast was applied from the toes to the hip, with the foot at right angles and in slight varus. Clinically, and in roentgenograms taken immediately after application of the cast, the fragments were in perfect apposition and the astragalus was replaced. Roentgenograms taken four and a half years after the operation indicated that complete absorption and disappearance of the beef-bone screws had taken place (Fig. 24). The ankle was functioning perfectly.

These fractures are commonly called Pott's fractures, although they are not true Pott's fractures and should not be

FIG. 23.—Beef-bone screw through internal malleolus following open reduction.

FIG. 24.—Roentgenogram of the ankle four and a half years after the use of bone screws in fracture of the malleolus. Absorption of screws may be noted.

treated as such. Attempts at forcing the foot into varus position with both malleoli torn loose, produce malposition of the frag-

ments and subluxation of the astragalus. This, unless corrected, results in permanent, partial disability due to malunion and incongruity of the joint. In Pott's fractures the varus position, with the internal malleolus intact, can do no harm, but in this instance attempts to reduce the fragments and to hold them in varus position, or even in the ordinary cast, were shown to be futile. I have seen fractures of both malleoli, treated as Pott's fractures, result in the most embarrassing situations, and I believe that it is of considerable medical and legal importance to draw a sharp distinction between treatment of the true Pott's fracture and fractures of both malleoli. In this instance repeated manipulation under anesthesia failed to reduce the fracture satisfactorily. I believe that fixation of the internal malleolus by beef-bone screws and proper reposition of the fibula constituted the operation of choice. If the facilities and experience of the surgeon are adequate, so that no undue risk is run in the matter of infection, better results are obtainable by such open reduction. In this instance, the physicians were unable to reduce the fracture properly, and after repeated trials and consultations operation gave a normal result.

Case IV. Bone grafting for delayed union following osteotomy and the use of a Lane plate.—A laborer aged thirty-one years was examined in May, 1929, because of a marked deformity of the right leg. A year before he had had a severe accident which had caused a compound fracture of the left tibia and fibula, fractures of the right femur, an intra-articular fracture of the right tibia and fibula, and crushing of the right foot. The left leg had been put on a plaster cast, and the fractures had united in a satisfactory position, so that apparatus for fixation had been removed in five weeks. The crushed right foot had become infected and the tendons had sloughed. The fracture of the right femur had been treated by the Thomas extension splint for two weeks, and then a cast had been applied from the ankle to the groin and had been kept on for about five weeks. The patient had walked the fourth month with crutches, had used a cane at the end of the fifth month, and had left the hospital at the end of the sixth month.

On examination, the right leg presented marked deformity. There was backward and outward bowing in the lower third of the femur, the head of the fibula was prominent, the knee was widened, there was moderate talipes equinus and there were scars over the dorsum of the foot and back of the heel. The right knee was flexed to 90 degrees. The Wassermann reaction of the blood and the urinalysis gave negative results. The blood count, the temperature, and the pulse rate were normal.

Since the deformity was unsightly, the patient was anxious to have it corrected, even though little improvement in function could be promised. The contractures about the knee and foot indicated that there would be difficulty in maintaining correction after osteotomy. Therefore, the use of a Lane plate, as well as a cast, was advised and applied at operation. The leg was encased in a spica plaster cast, from the toes, with the foot at right angles. The wound healed by primary union and roentgenograms indicated good position. The cast was changed and the stitches were taken out on the eighteenth day. Ten weeks after operation, roentgenograms failed to disclose evidence of callus or union, and a new cast was applied. The tem-

FIG. 25.—Malunion of femur of one year's duration.

FIG. 26.—Malunion of femur corrected by osteotomy and Lane plate applied.

perature and convalescence had been normal. The patient was given ergosterol, 2 c.c. twice a day, thyroid extract 1 grain three times a day, and cod liver oil, 4 drams three times a day. The cast was changed and roentgenograms failed to disclose evidence of callus or of union and, clinically, false motion was obvious. Massage, diathermy, and medication seemed ineffective. The patient was anxious to leave the hospital and four months had elapsed since osteotomy. Delayed union was present, with every indication of future nonunión and pseudarthrosis. Evidently something was interfering with normal formation of callus. The urine and blood were reexamined with negative results, and because conservative measures had been unsuccessful I advised removal of the steel plate to be followed by bone grafting. At

operation, one hundred twenty-seven days after osteotomy, fibrous union was found; there was no evidence of callus, the medullary cavity was filled with fat, and some of the screws holding the plate were loose. The tissue about the plate was discolored and was removed with the plate and screws. The ends of the bone were excised, and multiple grafts taken from the tibia were used. One graft, 5 cm. in length and 0.5 cm. in diameter, was placed in the medullary cavity, and cureted cancellous bone was packed between. A 15 cm. massive graft was placed on the outer side of the femur and securely fastened by means of four beef-bone screws. The numerous small grafts were placed about the resected ends. The wound was closed tightly, and a firm compression bandage was applied, with a spica cast extending to the

FIG. 27.—Bone grafts and beef-bone screws used following use of Lane plate; delayed union was followed by rapid union.

toes. In two and a half months the patient was dismissed from the hospital with firm union, wearing a caliper for protection. Three months after operation he returned home (Figs. 25, 26, and 27).

TUBERCULOSIS OF THE HIP, COMPLICATED BY PULMONARY TUBERCULOSIS, TREATED BY OSTEOTOMY AND ARTHRODESIS

Case V.—A man aged thirty-seven years came to the clinic in March, 1929, because of pain and deformity of the right hip of four years' duration. Twenty-five years previously he had fallen off from a bicycle and had been told that the right hip was dislocated. Open operation had been performed, the details of which were rather indefinite to him, and primary healing of

the wound had taken place. He had worn a cast for one year after the operation. As time had gone on he had limped slightly because of difficulty with the right hip and he had thought that the right leg was somewhat shorter. Twenty-one years after this accident and the operation, pain had developed in the hip. It had recurred at irregular intervals, and finally adduction and flexion deformity had resulted. His symptoms always had been worse in the winter, and the pain had been referred to the knee.

When I saw the patient he had recently lost 15 pounds in weight, had night pains and night sweats, required crutches, and the deformity of the hip was becoming more marked. He was 5 feet 6 inches in height, and weighed 124 pounds. His normal weight, he said, was 142 pounds. Blood pressure, pulse, and temperature were within normal limits. He walked with a marked

FIG. 28.—Tuberculosis of hip with adduction-flexion deformity.

limp, due to flexion and adduction deformity of the right hip. There was marked talipes equinus and marked atrophy of the right leg. Some râles were found in the apexes of both lungs. Results of urinalysis and of the Wassermann reaction of the blood were negative. Secondary anemia was present. Roentgenograms disclosed evidence of tuberculosis of the apex of the right lung, and on clinical investigation there was found to be some activity of this lesion. Sputum could not be obtained. Diagnosis was made of tuberculosis of the right hip joint with adduction-flexion deformity, and pulmonary tuberculosis.

I felt that arthrodesis and osteotomy under spinal anesthesia could be performed safely. Accordingly osteotomy was done, and bone grafts were used to produce extracapsular arthrodesis. The bone for the grafts was taken from the femur and the ilium. There was a slight discharge from the

wound following operation, but convalescence was otherwise uneventful. Casts were changed at intervals of several months. At the end of nine months the patient was up and around on crutches, and good, firm fusion was found to be present (Figs. 28 and 29).

Tuberculosis of the hip, if treatment is not given, results in deformity and drainage of material from the hip. In this instance operation has permitted correction of the deformity and fusion of the hip joint, with complete and permanent relief of pain. Also, the extremity is held in the most useful position

FIG. 29.—Postoperative tuberculosis of hip three months after osteotomy and arthrodesis.

for future function. I have performed similar operations a number of times with good results. I believe that fusion, combined with osteotomy, is practical, and that it saves the patients from disability for an unnecessary length of time. It is necessary, at times, to perform tenotomy of the adductor tendons and to use considerable force following osteotomy to obtain correction. The trochanters usually allow sufficient bone to be used as bone grafts. Fixation with plaster casts must be maintained until the surgeon is thoroughly satisfied that fusion is complete.

PSEUDOMYXOMA PERITONAEI OF OVARIAN ORIGIN: AN ANALYSIS OF THIRTY CASES

JAMES C. MASSON AND ROBERT A. HAMRICK

PSEUDOMYXOMA peritonaei, which frequently is referred to as "mucous ascites," is a condition of the peritoneum in which masses of gelatinous pseudomucinous or mucinous material is distributed over its surface either as a homogeneous layer or as multiple cystic masses. Pseudomyxoma peritonaei is of relatively rare occurrence. It is most often seen in women, associated with ruptured pseudomucinous cystadenoma of the ovary. More infrequently, it is encountered by the general surgeon following rupture of mucocele of the appendix. Other still less common sources of origin are discussed by different authors. The reception of the semifluid material by the peritoneum may be purely passive, or the response may be by generalized peritoneal thickening, cellular infiltration, the formation of connective tissue, producing firm adhesions, proliferation of secondary tumors, and formation of multiple cysts, or by a combination of all of these. It is not uncommon to find the reaction of the peritoneum different in various parts of the abdominal cavity. The gelatinous material may be colored in various shades of red, yellow, brown, and grayish-white, depending on the amount of hemorrhage, fatty material, cholesterol, and cellular detritus that occurs within the cystic masses.

Recently one of us (Masson) operated in a case reported by Dowley in which there was a cystadenoma in the anterior wall of the uterus, the lining cells of which resembled the cells in the endocervix; the acini were filled with clear, mucinous material. This might suggest implantation as the etiologic basis for these tumors.

FIG. 30.—A pseudomucinous cystadenoma removed with the uterus.

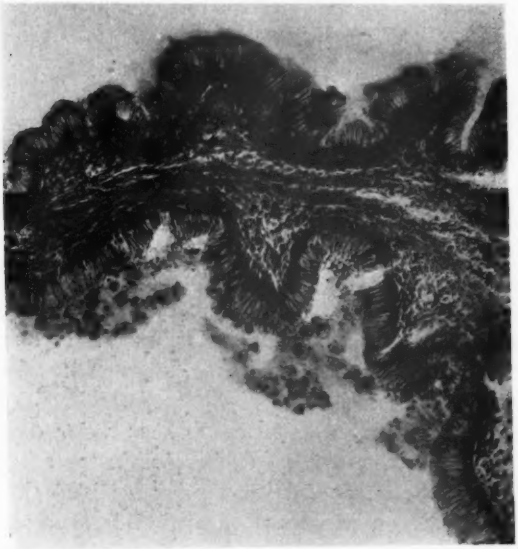

FIG. 31.—A portion of the wall of a pseudomucinous cystadenoma, showing the columnar cells of the epithelial lining. Much cellular débris is present.

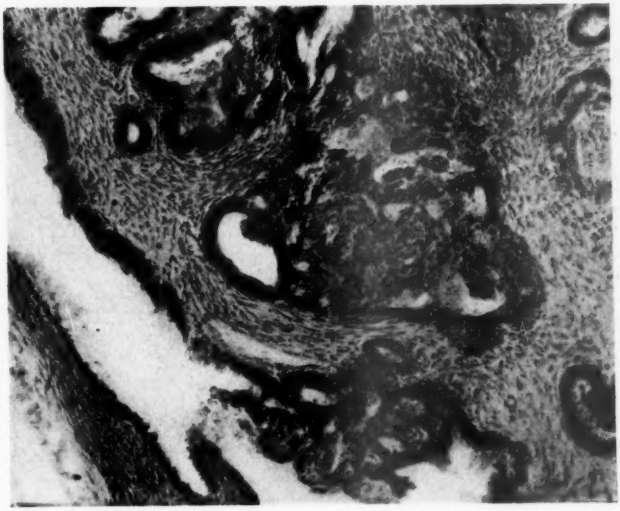

FIG. 32.—A section of malignant pseudomucinous cystadenoma.

FIG. 33.—Gross appearance of some of the pseudomucinous material removed at operation on a patient who had pseudomyxoma peritonaei of ovarian origin.

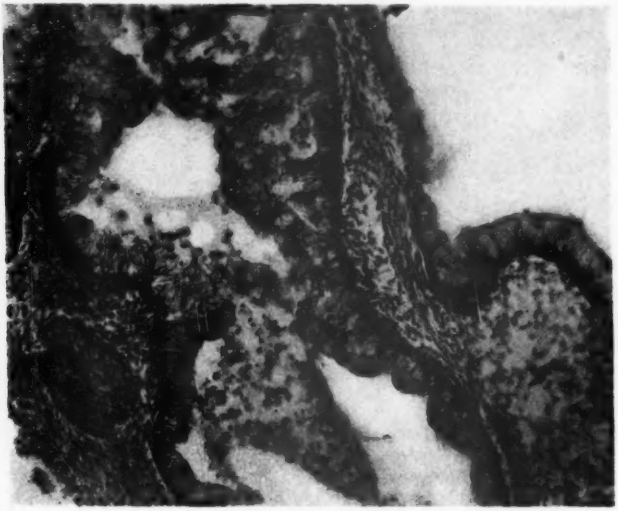

FIG. 34.—A section of a benign pseudomucinous cystadenoma with much cellular débris in lumen.

ANALYSIS OF CASES

The histories of thirty cases of pseudomyxoma peritonaei secondary to ovarian tumors seen in The Mayo Clinic during the last eighteen years, were reviewed. During the same period, 6,865 patients with benign tumors and 950 patients with malignant tumors of the ovaries were subjected to operation. Questionnaires concerning their present health were sent out to the thirty patients who were not known to be dead. The average age of the patients was forty-nine and nine-tenths years; the youngest was aged twenty-nine years, and the oldest sixty-three years. The greatest number, thirteen, of the patients were in the sixth decade. Eighty per cent of the patients were aged more than forty years. The thirty patients had fifty-four operations, thirty-nine of which were performed at The Mayo Clinic. Microscopic examination of the tissues removed showed thirteen (43.3 per cent) of the growths to be malignant, and seventeen (56.6 per cent) to be benign. There was a history of malignancy in the families of three of the patients, but in only one of these

patients was the myxomatous condition malignant. Twenty-eight of the patients were married and twenty-one of them had children. Of twenty-five cases in which the menstrual history was given definitely, in 84 per cent menstruation was normal and in 16 per cent there was a history of some irregularity previous to menopause.

The condition apparently gives little if any inconvenience until enlargement of the abdomen is noted. The complaint of increase in size of the abdomen was made by nineteen (63.3 per cent) of the patients. This was the only characteristic symptom in eight (26.6 per cent) of the cases. As a rule it is very gradual, but three patients noted rapid distention. Associated with the abdominal enlargement there may be either a gain or loss in weight. As pressure increases, such symptoms as bearing down, urinary frequency, and shortness of breath develop. Abdominal pain was the symptom next in order of frequency, and was characteristic in fifteen (50 per cent) of the cases. Six of the patients complained of acute attacks of pain. In some of the cases this was probably due to other conditions, as five patients had stones in their gallbladders, as well as pseudomyxoma peritonaei. One patient had an associated duodenal ulcer. Bloody vaginal discharge was complained of in four cases. In one case the discharge was markedly malodorous, and following hysterectomy in this case a degenerating cystadenoma was found implanted in the fundus of the uterus. Two patients gave histories suggestive of peritonitis with pyrexia; at operation they were found to have fistulae between the cysts and the intestinal canal. One of these also complained of attacks of diarrhea, and passage by rectum of considerable amounts of mucoid material.

Most of the patients had had symptoms for more than eight months before coming to the clinic, but one had been free of any suspicion of trouble until ten days before she arrived. There is no doubt that many of them had large symptomless tumors for a considerable length of time before trouble was suspected.

General examination of the patients usually revealed the presence, in the abdomen and pelvis, of a large tumor or of

more than one tumor. Sometimes very little could be palpated other than a large, tense abdomen and the questionable presence of a fluid wave. Mild secondary anemia was present in some instances. The amount of hemoglobin (Dare) was estimated usually as between 60 and 70 per cent. The lowest amount of hemoglobin, 31 per cent, was found in a patient twenty-nine years of age, who, in addition to carcinomatous pseudomyxomatous peritonaei, had localized peritonitis as the result of rupture into the terminal portion of the ileum.

At operation all the patients were found to have large quantities of gelatinous material free in the peritoneal cavity. In one case of intracystic and extracystic carcinomatous papillary pseudomucinous cystadenoma, 26 liters of fluid and semifluid material were removed from the abdominal cavity and the patient is still alive four years and eight months after operation; however there are symptoms of recurrence at the present time. In some cases there were secondary cystlike masses attached to the parietal and visceral peritoneum, with extensive, firm adhesions. In several cases the wall of the bowel appeared to be involved, and in separating adhesions and attempting to remove the material great care had to be exercised not to injure the bowel. Injury to the intestine occurred in two cases, and resection of the small bowel was necessary in one of them. Infected pseudomucinous cystic tissue was found in two cases as the direct result of the new growth extending through the intestinal wall. In ten cases the omentum was especially mentioned as showing marked involvement, and in four cases it was thought best to remove it entirely. In two cases mucocele of the appendix also was present. Besides the removal of the involved organs, as much of the gelatinous material as possible was manually removed at each operation. Some of the patients had multiple operations for the removal of gelatinous material from the peritoneal cavity. Drains were not left in the abdomen following operation in any case. Such a procedure is thought to increase the chances of peritonitis developing in these cases.

Both ovaries were affected in fifteen cases, the right only in nine cases, and the left only in six cases. In two cases in which

the disease was bilateral, a carcinomatous cyst was present in one ovary, and a benign pseudomucinous cyst, in the other. In one case there was chronic cystic oophoritis on one side and ruptured carcinomatous cystadenoma on the other. In another case there was a large ruptured pseudomucinous cystadenoma and a dermoid cyst in one ovary, and multiple simple cysts in the other ovary. Three patients had a normal or atrophic ovary on one side and a ruptured pseudomucinous cystadenoma on the other side. In two cases there was a small, hemorrhagic or tarry cyst, in one ovary and a ruptured mucilaginous cystadenoma in the other ovary. One woman had a simple ovarian cyst on one side and a ruptured pseudomucinous cystadenoma on the other side.

Although the gross appearance in pseudomyxoma peritonaei may be that of a malignant condition, on microscopic examination a carcinomatous condition is not always found. Definite microscopic evidence of a malignant condition was present in only 43.3 per cent of the cases. In 73.3 per cent of the cases in which involvement was bilateral, the condition was malignant. A papillomatous type of pseudomucinous cystadenoma was present in seven (23.3 per cent) of the thirty cases. Five of these seven patients had bilateral ovarian involvement and presented microscopic evidence of the presence of a malignant process.

There were five postoperative deaths following thirty-nine operations, a mortality rate of 12.8 per cent. Fifteen (50 per cent) of the patients had undergone, elsewhere than at the clinic, operations for cystic conditions of the ovaries or for pseudomyxoma peritonaei. Two of the postoperative deaths were from pulmonary embolism, and occurred, respectively, on the seventeenth and eighteenth days after operation. The other three patients died of peritonitis, respectively, on the fourth, sixth, and seventh postoperative days. One of these patients was known to have had pseudomyxoma peritonaei for six years and four months; another, for four years and two months.

There are records of seven cases in which the patients died apparently from the natural course of the disease (Table 1).

TABLE 1

VARIOUS DATA CONCERNING SEVEN PATIENTS WHO HAD PSEUDOMYXOMA PERITONAEI SECONDARY TO RUPTURED OVARIAN CYST WHO WERE OPERATED ON AND WHO HAVE DIED

Case.	Age at the time of operation, years.	Interval between onset of symptoms and death.	Interval between operation and death.	Malignant condition.	Radium or roentgen-ray therapy.	Cause of death.
1	57	4 months.	3 months, 10 days.	Present.	Given.	Apparently pulmonary embolism. Apparently cardiac failure.
2	45	3 years, 4 months.	3 years.	Absent.	Given.	Apparently intestinal obstruction.
3	58	Unknown.	2 years, 6 months.	Absent.	Given.	Intercurrent infection.
4	40	12 to 13 years.	11 years.	Absent.	Not known.	Died with marked jaundice, probably from tumor pressing on biliary tract.
5	59	10 months.	6 months.	Present.	Given.	Not given.
6	56	8 years, 11 months.	8 years, 3 months.	Absent.	Given.	Not given.
7	55	1 year, 6 months.	1 year, 5 months.	Present.	Given.	Not given.

TABLE 2

VARIOUS DATA CONCERNING TWELVE PATIENTS WHO ANSWERED THE QUESTIONNAIRE

Case.	Age at time of operation, years.	Interval between onset of symptoms and answering of questionnaire.	Interval between operation and answering of questionnaire.	Microscopic evidence of a malignant condition.	Radium or roentgen-ray therapy.	Health at time of answering questionnaire.
1	37	3 years, 1 month.	2 years, 2 months.	Present.	Given.	Gained 22 pounds; felt well; no enlargement of abdomen.
2	51	1 year, 3 months.	1 year, 2 months.	Present.	Given.	Gained 17 pounds; felt well; slight enlargement of abdomen.
3	48	Unknown.	1 year, 11 months.	Absent.	Not given.	Some slight abdominal pain; no enlargement of abdomen.
4	63	11 years, 6 months.	11 years, 2 months.	Absent.	Advised only.	Felt well; no enlargement of abdomen.
5	65	3 years, 11 months.	3 years, 7 months.	Absent.	Given.	Gained 20 pounds; felt well.
6	52	4 years.	3 years.	Absent.	Given.	Gained 50 pounds; felt well; no enlargement of abdomen.
7	41	5 years, 9 months.*	5 years, 9 months.	Present.	Given.	Gained 40 pounds; felt almost well; examined by physician; no knowledge of evidence of recurrence.
8	31	5 years.	4 years, 8 months.	Present.	Given.	Enlargement of abdomen; possible recurrence; symptoms of disease of gallbladder.
9	44	5 years, 2 months.	3 years, 8 months.	Absent.	Given.	Was continuing to improve.
10	52	6 years or more.	6 years.	Absent.	No record.	Felt well; no enlargement of abdomen.
11	57	4 years, 3 months.	3 years, 9 months.	Absent.	Given.	Felt better than for years; some enlargement of abdomen, although patient had lost 5 pounds; symptoms of colitis.
12	60	2 years, 4 months.	2 years, 3 months.	Present.	Given.	Gained 4 pounds; condition improved; some abdominal soreness.

*Or several months more.

Their average length of life after the onset of symptoms was four and three-tenths years. In all but one case treatment by radium or roentgen ray was given after operation. The shortest interval between the onset of symptoms and death was four months. In this case there was microscopic evidence of a malignant condition and death occurred at home suddenly, three months and ten days after operation. Death apparently was due to pulmonary embolism or to cardiac failure. In three of these seven cases microscopic evidence of a malignant condition was found at the time of operation, and the average length of life after onset of symptoms was ten and six-tenths months. The four patients in whose cases microscopic evidence of a malignant condition was not found, lived for an average of six and nine-tenths years after the onset of symptoms, or six and two-tenths years after the diagnosis of pseudomyxoma peritonaei had been made at operations. One of these patients lived twelve to thirteen years after the onset of symptoms, or eleven years after a definite diagnosis had been given at operation. She underwent five operations, and at the time of death she was deeply jaundiced. The jaundice was thought to be due to the pressure of tumors on the liver and the bile passages. Another patient lived eight years and eleven months after the onset of symptoms and eight years and three months after an operative diagnosis of pseudomyxoma peritonaei had been made.

Twelve patients who are living, at various intervals since the time of operative diagnosis, have answered questionnaires or recently have submitted to examination. Records of these patients are given in Table 2. One patient is living eleven years and two months after operation. At operation the following abnormalities were found: a ruptured multilocular pseudomucinous cystadenoma of the ovary, large quantities of gelatinous material in the abdominal cavity, and pseudomucinous implants over the intestines, omentum, mesentery, and surface of the liver. Microscopic evidence of a malignant condition was not found. This patient was sixty-three years old at the time of operation, and was advised to have postoperative roentgen-ray treatment, but no record to indicate that she submitted to

that kind of treatment was found. Two years previous to the time of her operation at the clinic a large ovarian tumor had been removed elsewhere. In reply to the questionnaire, she stated that, at the time she was writing, she felt well and that there had been no enlargement of the abdomen. Also, she had not undergone further operations. Four others of these twelve patients are living five years after onset of symptoms. In two of these microscopic evidence of a malignant process was found, and the abdomen of one of the two at present is markedly enlarged. Nevertheless, in her reply to the questionnaire she stated that she felt well.

Records of the necropsies of five patients who died following operation were reviewed. The peritoneum and abdominal cavity were found to be covered generally, or studded, with pseudomucinous masses. Some of these cysts were lined, in places, with epithelial cells of a kind which secretes mucus; these cells are either low cuboidal or high columnar in type. Some of the pockets of which the content was gelatinous had no special lining except connective tissue. Occasionally, a free cell, or more, was seen in the mucoid masses. The cystic masses contained many strands of connective tissue which could be seen both on gross inspection and on microscopic examination. In some cases pseudomucinous cystic masses were found embedded in the edge of the liver and spleen, but apparently they did not invade the parenchyma of these organs. In one case a cystic mass at the pylorus had caused obstructive dilatation of the stomach. In another case the muscle of the diaphragm was almost completely destroyed by a pseudomucinous tumor as the result of a perforation in the peritoneal surface of the diaphragm.

COMMENT

Chemical analysis was made of the gelatinous material obtained from four patients with pseudomyxoma peritonaei of ovarian origin. The material was alkaline in reaction and gave the chemical characteristics of pseudomucin. In two of these cases cultures were made for bacteria and for yeast; there was no growth in either culture.

In reviewing the analysis of the cases of pseudomyxoma peritonaei of ovarian origin, one is struck with the relatively large proportion (50 per cent) of bilateral ovarian involvement. In an analysis of thirty cases of unruptured pseudomucinous cystadenomas of the ovary, which will be given in another paper, bilateral involvement was found in only 24 per cent of the cases. Also, it should be mentioned that in this series of cases of unruptured pseudomucinous cystadenoma, there was microscopic evidence of a malignant process in 26.6 per cent, whereas in the series of cases of ruptured cystadenoma associated with pseudomyxoma peritonaei, there was microscopic evidence of a malignant condition in 43.3 per cent.

When a malignant condition is associated with pseudomyxoma peritonaei, it is usually of a low grade according to Broders' classification. The prognosis in pseudomyxoma peritonaei in which malignancy is found appears to be definitely worse than in those cases in which it is not found, although in two cases in which microscopic examination gave evidence of a malignant process, the patients are living for between five and six years after the onset of the symptoms. One of these patients, however, had marked enlargement of the abdomen when last heard from. Two patients are worthy of mention again: one is living, without symptoms, for more than eleven years after diagnosis was made at operation; the other died eleven years after the diagnosis was made at operation. There was no microscopic evidence of a malignant process in either of these cases.

Factors which bring about death attributable to the operation are pulmonary embolism and peritonitis. Death may be due to various factors other than the operation. Information about one patient who died at home was received by letter, and the symptoms before death were suggestive of intestinal obstruction. Another patient died in a condition of marked jaundice which was thought to have been due to the effects of pressure on the biliary tract. Very likely, pressure exerted by the abdominal tumors has a most important influence on a patient's well-being. Another patient died of intercurrent infection. It is known that the gelatinous cysts can perforate into a hollow

viscus. In two cases that have been mentioned perforation into the small bowel took place and in one case the uterus was invaded. Wilson mentioned a very unusual case in which, apparently, there was a metastatic pseudomucinous tumor in the lung; this was thought to have arisen from pseudomucinous cystadenoma of the ovary.

Probably the manner in which the body combats the disease is by walling off the gelatinous masses as thoroughly as possible. A patient whose case formed a part of this study underwent abdominal exploration eleven years after a diagnosis of pseudomyxoma peritonaei had been made at operation. Large quantities of unencapsulated and encapsulated pseudomucinous material was found at the second operation. The encapsulated gelatinous masses were mainly in the lower part of the abdomen. It was thought that the disease may have been reactivated, after the long interval, by rupture into the upper part of the abdomen of a mass that had lain encapsulated since the first operation. The encapsulation, or walling off, feature was noticeable in this instance and was probably the result of the ordinary peritoneal reaction against a foreign body.

Treatment of these patients is based on surgical measures, and on treatment by radium and roentgen ray. The surgical treatment has a twofold purpose, namely, elimination, as far as possible, of the etiologic factors, and relief from pressure. In a woman who is past the menopause removal of both ovaries and the appendix is urgently indicated. Frequently the peritoneal side of all the pelvic organs is involved. If the uterus is invaded, hysterectomy also is indicated. In a woman who has not passed the menopause it is desirable to save at least one ovary, and the surgeon should take into consideration the type of pseudomucinous cyst in the affected ovary. The incidence of bilateral involvement in these cases is greatest (73.3 per cent) when microscopic evidence of a malignant condition is present. The general incidence of bilateral ovarian involvement in the presence of pseudomyxoma peritonaei, as already mentioned, is 50 per cent. There are instances in which the omentum is so large and boardlike that its removal is worth while. As much

of the gelatinous material as possible should be scooped out of the abdominal cavity. This tends to alleviate pressure, and possibly helps the patient to increase resistance against the disease. Adhesions which cause intestinal obstruction should be freed, and any perforating injuries to the bowel should be given attention.

Eighteen of the thirty patients are known to have received courses of treatment by means of radium, deep roentgen ray, or both. Most of the others probably received treatment by roentgen ray after they went home from the clinic. Treatment by roentgen ray and radium should be given postoperatively in all the cases. Desjardins stated that mucoid tissues are usually very resistant to treatment by roentgen ray, but occasionally a patient's condition is improved after such treatment.

SUMMARY AND CONCLUSIONS

1. The largest number of cases of pseudomyxoma peritonaei of ovarian origin was found in patients in the sixth decade of life. The average age was forty-nine and nine-tenths years. Eighty per cent were past the age of forty.

2. Swelling of the abdomen and pain are the two most constant symptoms. The average duration of symptoms before operation was less than one year.

3. On general examination the pelvis and abdomen are usually found to contain one mass or more. A large, tense abdomen with a fluid wave, questionably present on palpation, may be the only abnormality found.

4. The right ovary was involved more commonly than the left in this series.

5. There is a higher percentage of bilateral involvement in patients with ruptured pseudomucinous cystadenoma than in patients with the same type of unruptured tumors. This bilateral involvement is specially marked in cases of malignant lesions.

6. In cases in which papillomas were present there was a high proportion of bilateral involvement.

7. Pressure phenomena from the mucilaginous tumors play

a large part in the health of patients with pseudomyxoma peritonaei.

8. Pulmonary embolism and general peritonitis were the chief factors in operative mortality in this series.

9. The prognosis is naturally better in cases of benign lesions. One patient lived for eleven years after diagnosis was made at operation, and another is living without symptoms eleven years after definite diagnosis. The duration of life after diagnosis may be from four to seven years.

10. Removal of both ovaries and the appendix is urgently indicated in women who have pseudomyxoma peritonaei of ovarian origin and who have passed the menopause. In women who have not passed the menopause it is generally desirable to save one ovary, and the surgeon should take into account the type of growth in the affected ovary. The leaving of one ovary is of questionable value. Hysterectomy is indicated in some cases; resection of the omentum is indicated in others. As much of the gelatinous material as possible should be manually removed from the abdominal cavity at the time of operation.

11. The bowel, and even the uterus, may be perforated or invaded by the pseudomucinous tumors.

12. Treatment by roentgen ray and radium should be given in all cases.

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MULTIPLE SPONTANEOUS ARTERIAL ANEURYSM

JAMES C. MASSON AND HAROLD D. CAYLOR

REPORT OF A CASE

THE patient a farmer aged sixty years came to the clinic complaining of loss of weight and strength. He had had diphtheria when a child, scarlet fever at the age of fifty-two years, and recently he had had an attack of tonsillitis. His father had died of heart trouble at the age of sixty-eight years, and his mother had died during pregnancy at the age of thirty-four years. He had two brothers and two sisters, who were living and well. He had had hemorrhoidectomy in 1915 and an operation for maxillary sinus in 1929, with satisfactory recovery in each instance. He had never been robust although he was able to work almost every day. The present illness began with gradual loss of strength and energy about four months before the patient came to the clinic. Eight weeks before examination he had had a sudden pain in the region of the urinary bladder that was almost constant for a few days and then gradually "wore off"; it was absent at first for a few hours, and it finally disappeared. Emptying the bladder seemed partly to relieve the pain. About a month before the patient came to the clinic and just about the time the distress in the region of the bladder disappeared he was seized with a sudden, severe, tearing, nonradiating pain in the right lower abdominal quadrant. This pain was constant and severe and lasted several days; then it gradually wore off. Residual soreness finally become localized near the umbilicus. For the last two weeks a burning sensation had been present in the epigastrium; it came on every day, usually about two to three hours after meals, and was relieved by food. At night the pain occurred between 2 and 3 a.m., and was relieved by hot fluid or food. During these two weeks the patient had lost about 14 pounds. This was probably due in part to voluntary restriction of food.

Examination revealed a palpable mass to the right of the umbilicus that seemed to be slightly cystic and tender. The blood pressure on two occasions were 176 and 120, and 150 and 110. The pulse rate was 96, and the temperature 98.6 F. Free acid was not present in the gastric contents and the total acidity was 12. The hemoglobin was 60 per cent (Dare). The erythrocytes numbered 3,570,000 and the leukocytes 9,500. Roentgenograms of the stomach, gallbladder, chest, colon, kidneys, ureters, and bladder were negative. The Wassermann reaction of the blood was negative. After many consultations it was decided to explore the cystic abdominal mass near the umbilicus.

Combined ether-ethylene anesthesia was used. Operation revealed multiple aneurysms of some of the smaller arteries in the mesentery of the bowel and around both curvatures of the stomach. Two of these aneurysms were thrombosed, making a mass approximately 4 by 2 by 2 cm., in the middle of the abdomen. These were removed for microscopic examination. Other tumors or signs of gross disease in the abdominal cavity or its contents were not present.

The patient was dismissed from the hospital in two weeks with the wound healed. Six months after the operation he was able to be about and to do light work.

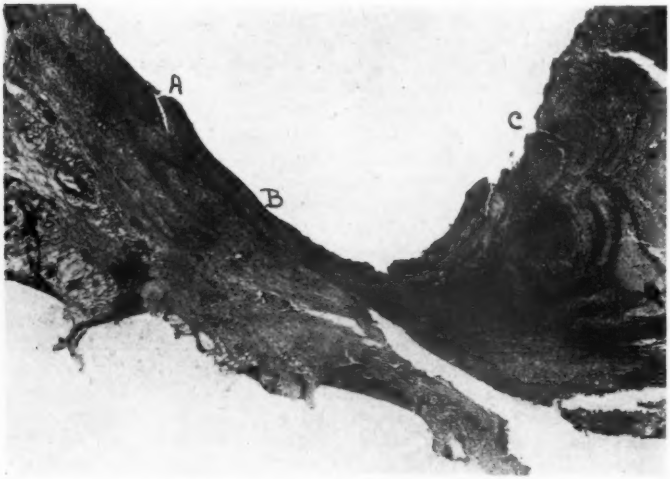

FIG. 35.—The wall of an artery and a thrombosed aneurysm: A, the elastic connective tissue is broken and the intima is thickened; B, the clot along the wall begins; the media here is in part replaced by fibrous connective tissue and by organized blood clot; the wall is thinned and the aneurysm begins here; C, laminated blood clot in the aneurysm (× 15).

Histologic examination of sections through the thrombosed aneurysms were all very much alike. There was proliferation of the intima of the vessels and at one place (Figs. 35, *a* and 36) the internal elastic connective tissue was broken. Beyond this area of fragmentation, which was really the origin of the aneurysm (Fig. 35, *b*), the media was separated and replaced, in part by connective tissue and by organizing blood clots (Figs. 35, *b* and 36). Still further to the right of the picture (Fig. 35, *c*) were the laminated blood clots so commonly seen in thrombosed aneurysms. As the wall of the aneurysm became increasingly thin the clot above it seemed to become increasingly thick (Figs. 35 and 36).

FIG. 36.—Higher magnification of the area in Fig. 35, *a*, illustrating the proliferation of the intima with fragmentation of the elastic layer (× 75).

COMMENT

Kaufmann described multiple miliary aneurysms which apparently arose on the basis of previously existing arteriosclerosis. They are described as occurring usually in the brain, intestine, and lungs. The aneurysms in the case reported here also arose on the basis of arteriosclerosis and are similar to those described by Kaufmann except that they are larger.

Kolodny reported data concerning a patient who had multiple aneurysms of the right axillary, the left carotid, the right external iliac, and the right popliteal arteries, and of the thoracic descending aorta. He likewise ascribed arteriosclerosis as the most common cause of the disorder and syphilis as the next most common cause. Many other observers[1, 4, 5] have reported

multiple spontaneous aneurysms, but most of these concern post-mortem observations.

In our case it is difficult to determine just what particular symptoms to ascribe to the presence of the aneurysms, but since exploration of the abdominal cavity was otherwise negative some correlation must exist between the symptoms and the aneurysms. The case demonstrated again the value and occasional necessity of surgical exploration as a diagnostic procedure. The clinical data and history, that is, the periodic pain, mild anemia, loss of weight, palpable abdominal mass, and the absence of free acidity in the gastric contents, all pointed toward a malignant gastric lesion and only by operation, with removal and examination of tissue, could the diagnosis be established.

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CASES FROM THE CLINIC OF HAROLD I. LILLIE ASSISTED BY HENRY L. WILLIAMS, JR.

HAROLD I. LILLIE ASSISTED BY HENRY L. WILLIAMS, JR.

BILATERAL SIGMOID SINUS PHLEBITIS AS A CAUSE OF GENERAL SEPSIS

A BOY aged four years whose ears were discharging was seen at the clinic February 20, 1928. Two weeks and a half before this an acute upper respiratory tract infection had been followed by pain in the right ear. The tympanic membrane ruptured spontaneously and the ear began to discharge. A few days later the left ear began to discharge. The child had slept poorly and he had had a fever of 102° F. On admission the patient complained of tenderness and pain above and behind the right ear for the first time. Both sides of the neck had been tender and swollen for several days.

The right canal was found to be filled with a large quantity of purulent material and there was a small perforation in the anterior superior quadrant of the tympanic membrane. The left canal contained a large quantity of purulent material and there was a pin-point perforation anteriorly. Tenderness of the mastoid or sagging of the superior wall of the canal was not present on either side. The mucous membrane of the upper respiratory tract was generally injected and a bilateral cervical swelling with palpable nodes on the right side was noted. A roentgenogram disclosed cloudiness and a diploic type of mastoid on both sides. The thorax, heart, and lungs were normal.

Two days later the condition had not changed except that large palpable nodes were present in the anterior triangle on the left side. Because of the type of temperature, the patient was hospitalized and hot compresses were applied over both mastoids. The septic type of temperature continued, and on the second day after admission a definite constriction of the left canal was noted without, however, any drooping of the superior wall of the canal or any tenderness of the mastoid. An odor of acetone, evidence of acidosis, was noted on the breath. Potassium citrate, 1 dram every three hours, and an enema of 180 c.c. of 10 per cent glucose solution were given twice a day. The child was encouraged to drink orange juice and was given a diet high in carbohydrate. The septic type of temperature continued. On the fifth day after admission the palpable nodes on both sides of the neck had disappeared and definite sagging of the superior wall of the left canal was noted. A tentative diagnosis of sinus phlebitis on the left side was made and the left mastoid was opened.

The mastoid was of the diploic type, with all the cells filled with infected granulations. Trautman's triangle was particularly well developed and the zygomatic cells were extensive. The knee of the sinus was superficially placed in relation to the cortex, and after it was uncovered the dura was found to be reddened, and the wall was found to bleed rather unusually from pin-point areas. The sinus was uncovered extensively above and below the knee of the sinus, but absolutely normal dura was not encountered. The wound was closed, a small pad soaked in petrolatum was placed in the wound, and a wick was placed in the ear.

On the eighth day after operation the right canal was dry and the tympanic membrane was rapidly returning to normal color and luster. The wound appeared to be in good condition with no particular pulsation of the sinus and complete resilience on palpation. However, the temperature was still of the septic type. Culture of the blood on the ninth day after admission did not show growth in forty-eight hours. On the tenth day after admission the cervical lymph nodes were no longer palpable and it was considered possible that the absorption consequent to their rapid disappearance might account for the continuance of the septic temperature. The right canal remained dry and the tympanic membrane had resumed a normal appearance. On the eleventh day it was decided that there might be thrombosis of the left sigmoid sinus, but previous to investigation of the vein the right mastoid was explored. It was found to be of the diploic type. All the cells were red; occasionally one contained some mucus, but pus was absent. The sinus was exposed for a wide area, and over the knee of the upper turn there was a definite area of phlebitis. Nothing was found suggestive of thrombosis and the sinus was left undisturbed.

The left mastoid was then explored. The sinus was opened although it looked and felt as if it were in good condition. It bled freely and was therefore considered normal. A pad was placed over it and the wound was closed. The following day the child's general condition was markedly improved, the temperature became normal on the fourth day after operation, and he proceeded to an uneventful recovery.

The first diagnostic difficulty in this case was in deciding which of the two mastoids to open at the first operation. The left mastoid was decided on because it has been the experience at the clinic that if ears are discharging and signs of otitic sepsis are present, the seat of disease is usually to be found on the side on which is the most pronounced cervical adenopathy.

With the failure of a favorable response to the first operation it was necessary to decide whether the continued fever was due to the formation of a thrombus in the vein of the side which had been operated on, or to sinus phlebitis on the opposite side, similar to that found at the first operation. Although the discharge from the right ear had ceased and the membrana tensa

had resumed a normal appearance, it was decided to operate on the right mastoid first because careful inspection of the side operated on gave every indication of its being in good condition. From experience with hemorrhagic mastoiditis it has been learned that sinus phlebitis might exist without suppurative disease of the mastoid process, particularly in the diploic type. This can occur even when the middle ear appears to have become quite normal after an attack of otitis.

One factor which led to the decision to operate on the right side was that if the left vein was opened and sufficient pathologic change was not found to account for the symptoms, it would then be necessary to open the right mastoid and face the added danger of opening the right sinus if it was involved, inasmuch as it is generally considered necessary to allow an interval of time for compensatory circulation to become established between ligation of the two jugular veins.

The experience in this case shows the importance of hospitalization and careful observation. The early recognition of extension of infection to the blood stream is imperative if the condition is to be dealt with in what might be called a conservative manner. In this case, as in others reported by one of us (Lillie), removal of the source of infection before thrombosis frequently obviates the necessity of interference with the venous sinus.

ACUTE FULMINATING SEPTICEMIA ASSOCIATED WITH OTITIS

A girl aged seventeen years entered the clinic March 29, 1928, complaining of tenderness over the right mastoid region. Two weeks prior to admission she had an acute attack of coryza of a mild type with a sore throat. In three days a severe earache developed in the right ear which lasted for two days; then the ear drum ruptured and the ear discharged copiously. In a day or so she noticed fulness, tenderness, and pain over the right mastoid. The day before admission to the clinic, she had a severe frontal headache, with vomiting and chills, followed by a temperature which rose to 104 F.

Examination showed the left tympanic membrane to be slightly reddened at the periphery and in the region of Shrapnell's membrane. The right canal was filled with a large quantity of creamy yellow pus, and was swollen and constricted in its entire length. There was an inferior perforation and some pulsation of the discharge. Questionable drooping of the superior wall of the canal was noted. Over the right mastoid process there was slight

swelling and redness, and a moderate amount of tenderness on pressure. Examination of the nose, nasopharynx, pharynx, and larynx was negative except for generalized injection of the mucous membrane of the upper respiratory tract. Examination of the heart, lungs, and abdomen was negative. The temperature was 104.2 F. A diagnosis was made of acute otitis media with mastoiditis and it was thought probable that sinus phlebitis of a hemorrhagic type was present.

The patient was hospitalized immediately. Culture of the blood disclosed 5 colonies to 4.2 c.c. of blood in twelve hours.

Operation on the right mastoid was performed at once, and a hemorrhagic type of mastoiditis was found. The lining membrane of the air cells was red and engorged. There was very free bleeding. A small quantity of free pus was found in the cells. The cells were exenterated and the tip was removed. The sinus was uncovered and found to be normal in appearance and to palpation. The vessels of the large bone at the side of the sinus bled freely but the sinus was not injured. The wound was lightly packed, care being taken not to cause pressure on the sinus, and the wound was closed only at the upper angle.

Following the operation the patient looked extremely ill, and the temperature rose to 105 F. A transfusion was given for its tonic effect, and there was no reaction. The temperature fell and the general appearance of the patient improved. On the third day after operation the patient complained of pain in the right knee. The joint was swollen and tender, but the leg either above or below was not involved. By evening the right ankle had become involved. A diagnosis was made of acute arthritis of the right knee and ankle joints. Another transfusion was given, with repetition of the improvement in the general condition, and there was a fall in temperature. A blood culture was taken the day of the operation and 1 colony of hemolytic streptococcus to 4.5 c.c. of blood was found. There was a return of the high fever on the fifth day, and another transfusion was given: 200 c.c. of blood was removed from the patient and 250 c.c. of blood from a donor was given. A blood culture on the fifth day did not show growth in forty-eight hours.

A complete dressing of the mastoid wound was done on the sixth day, and the wound appeared to be in good condition. The appearance of the patient improved steadily although a high fever continued. It was thought that the fever might be a result of the acute arthritis which on the eighth day had involved the left elbow. About 5 a.m. on the twelfth day after operation the patient became suddenly irrational, and there was some rigidity of the neck. The condition became gradually worse and she became stuporous. A spinal puncture was done; the fluid was under too high a pressure to be measured, and it was greenish-yellow and cloudy. A diagnosis was made of acute cerebrospinal meningitis. The patient failed rapidly and died at 11.20 p.m.

The principal observations at necropsy were acute suppurative otitis media with mastoiditis on the right side, and acute cerebrospinal meningitis.

The severity and rapidity of the onset of symptoms, the hemorrhagic type of disease, and the positive blood culture, without sinus phlebitis or thrombosis, showed the presence of an intensely virulent infection. In other cases of this type immediate ligation of the jugular vein had not favorably influenced the course of the disease so was not deemed advisable under these circumstances.

It is not probable that a continuance of the transfusions on alternate days would have had a favorable influence on the course of the disease. The terminal meningitis was probably blood borne and too fulminating to permit of effective treatment. Spinal puncture early in the course of the disease might have afforded diagnostic data, although only the somnolence and severe headache suggested meningeal irritation. With an infection of this type the prognosis is always extremely unfavorable; however, occasionally some of the patients get well. It is probable that the otitic disease was merely an incident in the septicemia arising from an acute upper respiratory tract infection, because of the other evidence of generalized infection.

SPONTANEOUS BLEEDING FROM A NONMALIGNANT FAUCIAL TONSIL

A man aged fifty-five years came for consultation because, during the previous week, the left tonsil had bled spontaneously. The amount of blood lost at any time was small, but he had become apprehensive and had thought the bleeding was a sign of malignant growth. Symptoms, referable to the throat, had not been present before the onset of bleeding.

Examination revealed an irregular papillary growth involving the left tonsil extending down toward the lateral pharyngeal wall. It was not fixed. The surface was superficially ulcerated. A small lymph node could be palpated in the left submaxillary region. Quite naturally it was felt that the lesion was malignant because of the age of the patient, the appearance of the growth, and the symptoms. However, repeated biopsy was negative and at tonsillectomy it was seen that the capsule was intact. Careful examination of the tissue did not reveal any evidence of malignancy. The outstanding pathologic observation was ulceration of the crypts.

This same type of syndrome has not been encountered heretofore. Without pathologic examination of tissue removed at biopsy and later of the specimen, one would not have been

certain about the diagnosis. In the past, pathologic examination of specimens of the tonsil has revealed small malignant lesions not recognized clinically. One patient operated on ten years ago was recently observed. A pathologic diagnosis of squamous-cell epithelioma, graded 3, was made long after the operation. The patient was in excellent health. Unrecognized malignancy is probably present more frequently than is supposed. Only pathologic examination made as a routine will determine the actual changes in the tonsil.

DELAYED PULMONARY INFARCT FOLLOWING INJURY TO SIGMOID SINUS DURING RADICAL MASTOID OPERATION

A woman aged thirty-two years had had a discharge from the left ear since early childhood. Two years previous to admission a mastoid operation had been performed because of severe pain and swelling over the mastoid, and facial paralysis occurred during the exacerbation. The pain disappeared and the facial paralysis almost disappeared. After two months the pain recurred. The discharge had continued to be profuse and foul-smelling.

On examination the left ear was found to be tender to touch or manipulation. The canal was so much constricted that a small speculum could not be introduced. A probe could be passed into a rather small cavity extending to the mastoid region. The postauricular scar was healed. Roentgenograms revealed the apparent absence of mastoid cells. Exploration and radical mastoidectomy was advised.

At operation it was found that the cavity was filled with débris and cholesteatoma. This was thoroughly cleaned out. In fashioning a radical cavity in the eburnated bone a small pocket above the tip and behind the posterior wall of the canal was found. On investigating this pocket with a smooth probe the sigmoid sinus was opened, but the severe bleeding was readily controlled. After a plastic type of operation on the constricted membranous meatus, the operation was completed. On removal of the pad over the injured sinus the bleeding ceased.

The postoperative course was without incident until the seventh day, when suddenly, during the afternoon, the patient experienced a severe pain in the right lower side of the thorax posteriorly. The pain was increased by respiration. The temperature did not rise and blood counts were found to be within the range of normal. Roentgenograms revealed what was thought to be extensive pneumonia of the lower right lobe. Pneumonia, without fever, increased leukocyte count or apparent illness, did not seem plausible and therefore a diagnosis was made of pulmonary infarct. This phenomenon has been observed following tonsillectomy. It is probable that a portion of the sterile thrombus in the sigmoid sinus caused the infarct. From experience in other cases in which the sigmoid sinus has been injured, intentionally or otherwise, we believe that it always adds greatly to the danger of subsequent complications. Recovery of the patient was gradual and complete.

EFFECT OF THE APPLICATION OF RADIUM IN HYPERPLASTIC FRONTAL SINUSITIS

A boy aged fourteen years came to the clinic for examination, with a history of having taken a severe cold following swimming ten months previously. At that time severe pain had developed in the supra-orbital region, with swelling, redness, and tenderness in the same region. An external operation on the right frontal sinus was done four days after the onset of the symptoms. Immediately after the operation, swelling, tenderness, and redness at the inner canthus of the right eye and an external squint and proptosis of the eye occurred. There was continuous drainage of pus through a fistula near the mesial part of the incision. The patient then visited a clinic elsewhere where polypi were removed from both sides of the nose and an external operation was done on the right frontal sinus. For about a week following this operation, there was drainage of pus through the nose in addition to that through the fistula in the external wound and, then, because of filling up of the nasal fossa with polypi, the whole discharge came through the fistula in the external wound. A month later the patient was again operated on at the same clinic, and at operation a communication was found with the left frontal sinus. This operation, also, was without beneficial effect; the discharge through the sinus in the right frontal region continued, and polypi were removed from the nose almost daily. During the three weeks before admission he had had pain in the eyes and temporal regions which was eased by discharge of pus through the sinus in the right frontal region.

Except for large infected tonsils the examination of the pharynx, larynx, and ears was negative. The right nasal cavity was completely blocked with polypi and there were several polypi springing from the region of the middle turbinate on the left. There was a scar in the right supra-orbital region with a large fistula near the inner angle of the eye from which sprang elevated, firm, granulation-like tissue covered with pus. There was a defect in the external table over the right frontal sinus, and on probing a defect in the septum within the sinus could be felt. The right nasopharynx was seen to be filled with a polypoid mass. The pupils of the eyes were found to be equal, and the reactions were normal. Vision on the right was 6/7 and on the left 6/7. Ocular movements were good even to convergence, but there was a divergent squint of more than 35 per cent in primary position. Roentgenograms of the sinuses were reported negative except that the frontal sinus was very large on both sides. Biopsy of the tissue presenting through the sinus in the right frontal region was diagnosed as inflammatory tissue. Examination of the heart and lungs was negative. The Wassermann reaction was negative. A diagnosis was made of bilateral hyperplastic frontal sinusitis with external manifestation, involvement of the fronto-ethmoid cells on both sides, and possibly orbital abscess on the right.

It was decided to perform a two-stage radical operation of the Killian type on both frontal sinuses. At the intranasal stage of the operation, the hyperplastic and granulation tissue in both middle meatuses was thoroughly removed and the nasofrontal ducts were enlarged satisfactorily. The frontal sinuses were found filled with polypoid tissue throughout, as were the fronto-ethmoid cells which extended all around the upper portion of the orbit to the

apex. The external table was removed to the outer rim of the orbit on both sides and the edges were beveled. The lining membrane of the sinuses and ethmoid cells was completely curetted away. The supra-orbital brim was taken down low in order to equalize the sides. The left side was closed in the usual way and plastic closure of the previous operative defects was attempted on the right side. The wound healed satisfactorily except in the region of the previous sinus, where union failed.

About a week after the operation polypi began to form in both sides of the nose and could be seen forming in the right frontal sinus and fronto-ethmoid cells through the operative defect on the right. Two weeks after operation a 50 Mg. tube of radium was introduced into the nasofrontal duct on each side and was left in place for an hour and a 50 Mg. plaque was placed in three areas over the frontal sinuses and left for an hour in each area. This application had little, if any, effect on the polypi either in the nose or in the sinus. Five weeks later, a 50 Mg. tube of radium was placed in the upper pole of the nose on either side and left in place for two hours. Following the application of radium there was marked reduction in the amount of polypi in both upper poles of the nose; the polypi which remained were grayish and apparently degenerating. The polypi in the right frontal sinus, however, as seen through the operative defect, remained red and beefy in appearance. Eight weeks later a 50 Mg. tube of radium was placed in the right frontal sinus through the operative defect and left in place for three hours. Following this, the polypi in the frontal sinus began to melt away and assumed a grayish degenerating appearance. At no time was any radium reaction seen on the skin of the forehead or the nose. Five months after the last application of radium both upper poles of the nose were completely free of hyperplastic, tissue and a normal appearing membrane could be seen over the right frontal sinus and fronto-ethmoid cells to the apex of the orbit. It was decided to wait six months to be certain that there would be no recurrence of polypi, and then the opening of the operative defect was covered with a flap lined with skin, and resulted in a perfect closure.

After wide opening of the frontal sinuses and fronto-ethmoid cells on both sides, with complete removal of their lining membranes, the good results of the operation were endangered by the rapid recurrence of polypi in the upper poles of the nose and in the frontal sinus. It was, therefore, necessary to vary the mode of attack, and by the use of radium to accomplish such destruction of the recurring polypoid growths as surgical removal was unable to effect.

SCARRING AND ULCERATION OF THE NECK AFTER IRRADIATION; RECONSTRUCTION OF THE UPPER LIP AND CHEEK; RECURRING CYST OF THE FLOOR OF THE MOUTH; KELOID OF THE NECK; OSTEOMYELITIS OF THE JAW; FIBROSARCOMA OF THE HYPOPHARYNX

GORDON B. NEW

SCARRING AND ULCERATION OF THE NECK AFTER IRRADIATION

Case I.—A girl aged fifteen years came to the clinic January 24, 1929, with a roentgen-ray burn and ulceration in the left submaxillary and upper cervical region. About four years previously there had been a swelling in the left submaxillary region which was drained. A diagnosis of tuberculosis was made. Twenty-two roentgen-ray treatments and three radium treatments had been given since that time. In the last few weeks there had been some swelling in the region of the scarring, which had caused almost complete ankylosis of the lower jaw.

Examination revealed an inflammatory mass in the left submaxillary and upper cervical region, with a thickened scar about it. There was an indurated ulcer just below the angle of the jaw in the center of the scar, about 2 cm. in diameter (Fig. 37). This was fixed to the margin of the jaw. There were small palpable, apparently inflammatory, lymph nodes below the ulcer in the neck. Analysis of the urine showed: amount, 450 c.c.; specific gravity, 1.015; reaction, acid; albumin, 0; and sugar, 0. The hemoglobin was 80 per cent.; erythrocytes numbered 5,170,000, and the leukocytes, 10,500. The Wassermann reaction of the blood was negative. The tuberculin test was positive. A diagnosis of ulceration and scarring caused by irridation, with secondary infection and cellulitis, was made.

Hot compresses were recommended in an attempt to reduce the acute inflammatory condition, and later, wide excision of the entire scar to be replaced by a flap from the back. Under hot compresses the inflammatory condition gradually subsided and the patient was able to separate the teeth and move the jaw. February 8, 1929 a tube flap was made on the left side of the back, about 12.5 cm. long, to replace scarring in the left submaxillary and cervical regions (Fig. 38). The ulcer was excised in the left submaxillary and upper cervical region. This proved microscopically to be inflammatory calcareous necrotic tissue. The tube flap healed nicely and the patient returned July 1, 1929 for excision of the scarring, to be replaced with a pedicle flap from the back. The distal end of the flap was cut away and, after the central core had been excised, it was sutured in place in the left submaxillary region, replacing the thickened, scarred, broken-down area (Fig. 39). The

last stage of the plastic work was completed August 12, 1929, when the flap was completely sutured in place in the left submaxillary region and the wound in the back was closed (Fig. 40).

FIG. 37 (Case I).—Thickened ulcer at the angle of the jaw, and the inflammatory mass with much scarring in the submaxillary region; the jaw was completely ankylosed.

FIG. 38 (Case I).—The tube flap on the left side of the back is shown.

There are several points of interest in this case: (1) The repeated irradiation that was given for what was apparently a tuberculous lesion, and the subsequent thickened scarring that resulted. It would seem that wise

excision of the lymph node might have saved the patient considerable scarring and deformity. (2) The acute inflammatory condition with complete

FIG. 39 (Case I).—The distal end of the tube flap replaces the upper portion of the scar.

ankylosis of the jaw at the time of the first examination made it difficult to determine whether the condition was inflammatory, or malignant secondary

FIG. 40 (Case I).—Completion of the suturing of the flap after excision of the scar.

to the breaking down of the scar. Malignant changes in scars following irradiation frequently occurs. Hot compresses and wide excision of the lesion

cleared up the diagnosis. (3) The use of the tube flap from the back, keeping the upper end of the tube well below the neck, is the procedure of choice. While the flap night have been brought up from the abdomen, this would have necessitated several additional stages. The possibility of replacing the lesion with a full-thickness skin graft was considered, but on account of the infection present and the marked atrophy of the tissue, this was not thought advisable. The cosmetic result, too, is much better; the color of the skin is better when a tube flap is used than is usually the result when full-thickness skin grafts are used. In this particular case the tube flap was delayed three months, which adds considerably to the facility with which the flap may be moved about.

RECONSTRUCTION OF THE UPPER LIP AND CHEEK

Case II.—A woman aged twenty-seven years came to the clinic, November 17, 1927, on account of loss of the upper lip and a portion of the

FIG. 41 (Case II).—Loss of the upper lip and part of the right cheek, with contraction of the mouth, the result of paste treatment for supposed cancer.

cheek, five months previously. She had had a small lesion of the upper lip, which had been treated by a cancer quack by means of a caustic paste. The upper lip sloughed away, leaving great loss of tissue and exposing the upper teeth. The patient came to the clinic for plastic reconstruction.

The oral orifice was narrowed. There was considerable scarring of the right cheek (Fig. 41). It was recommended that a flap be made from the forehead with a pedicle in the left temporal region, and that, after lining it with a full-thickness skin graft, that it be brought down to replace the lost upper lip and cheek.

The plastic procedure was started, November 25, 1927. The flap was elevated from the forehead and temporal region, and the distal 6 cm. of the

FIG. 42 (Case II).—Postoperative appearance of the reconstructed lip; the vermilion margin was made by the patient with cosmetics; anterior view.

FIG. 43 (Case II).—Same patient as is shown in Figure 42; lateral view.

flap was lined with a full-thickness skin graft taken from the inside of the left arm. The flap was brought down in position after some of the scar on the

right cheek had been excised. The area on the forehead was replaced with a full-thickness graft. After the flap had remained in place for two weeks, it was cut across and replaced on the forehead. The last plastic procedure was done, February 4, 1928.

The patient returned, November 6, 1929. The lip was now shortened and the angles of the mouth were enlarged by splitting the angle laterally into the cheek and suturing the mucous membrane out to the skin (Figs. 42 and 43).

At the present time the use of pastes and plasters in the treatment of benign lesions by quacks seems to be a common procedure. Carcinoma of the lip in a woman is rare, and in the upper lip on the vermillion margin it is almost unheard of. Basal-cell epithelioma, however, starts in the skin and may affect the upper lip. From the description of the primary lesion, however, it is questionable whether this lesion was malignant. In reconstruction of the upper lip of a man, a double-pedicled flap with a pedicle in either temporal region and the middle portion lined with a full-thickness graft may be used. This gives the advantage of having hair on the lip which may ultimately be utilized as a mustache. If, however, the patient is a woman, the forehead is the preferable place to obtain a flap, as the patient's hair may be used to cover the scarring and a full-thickness graft which replaces the area in which the tissue was utilized to form the lip. In the present day, cosmetics may be used to make a vermillion margin, as was done in this case.

RECURRING CYST OF THE FLOOR OF THE MOUTH

Case III.—A woman aged thirty-one years came to the clinic, October 11, 1929, for recurring cyst of the floor of the mouth, of five months' duration. It had been excised by a physician four and a half months before examination. The cyst, however, had reformed and had been opened several times.

Examination revealed a cyst in the floor of the mouth; the ventral surface of the tongue bulged, filling in the area between the anterior portion of the tongue and the posterior surface of the lower jaw.

The patient was operated on, October 15, under intratracheal gas anesthesia. With the tongue retracted into the mouth, the cyst was readily exposed. It was about 8 cm. in diameter, and extended about 5 cm. back underneath the tongue on the left side. The wall of the cyst was incised in the floor of the mouth and then, by picking up the walls with stomach forceps, and pressure in the submental and submaxillary regions, it was possible to expose the entire lining of the cyst. By means of a small needle used with surgical diathermy, it was possible to destroy the entire lining of the cyst thoroughly. The walls were then brought together with catgut and a small iodoform gauze pack was inserted into the base of the pocket. The patient recovered uneventfully, and was dismissed from observation two weeks later with the wound in the mouth practically healed.

Cysts of the floor of the mouth may be of various types. The most difficult to take care of is the multilocular cyst with a very thin wall. This type probably originates from mucous glands. Surgical removal is sometimes

difficult on account of the thin wall and the fact that the wall tears easily, in a manner similar to the tearing of wet tissue paper. Exposure of the entire cyst is not difficult by the method outlined; this gives a much better chance of permanently eliminating the lining than any other method I have used.

KELOID OF THE NECK

Case IV.—A woman aged thirty-six years came to the clinic, May 17, 1929, because of a keloid on the left side of the neck. She stated that two and a half years previously she had received a wound in the neck in an automobile accident. Since that time the scar had grown gradually. She had not been treated.

FIG. 44 (Case IV).—Keloid of the left side of the neck.

Examination showed the keloid to be about 12 cm. long and 2 cm. wide (Fig. 44). In view of certain results obtained in a French clinic, it was thought advisable to treat the lesion with surgical diathermy. May 18, 1927, this was applied, a small needle point being used. Following the treatment the wound healed, and an excellent result was obtained with no tendency to further formation of keloid (Fig. 45).

The treatment of keloid, until the use of diathermy, was best taken care of by radium, used in direct contact with the keloid except for 1 mm. of lead used as protection. Improvement after treatment by radium of a large lesion, however, is slow and the treatment should be repeated for a considerable period. The use of diathermy seems to be of distinct advantage and has

FIG. 45 (Case V).—Appearance after destruction with surgical diathermy.

given very satisfactory results. Radium might be used in this case to complete the smoothing out of the narrow scar.

OSTEOMYELITIS OF THE JAW

Case V.—A man aged thirty-nine years came to the clinic, January 6, 1927, with infection of the right lower jaw. Four weeks previously the patient had had a toothache; a right lower molar was removed and the gum was incised on the same day. Extensive swelling occurred and progressed rapidly, with pain. On the seventh day an incision was made in the submaxillary region. On the tenth day free drainage was established both inside and outside the mouth. The teeth in the entire right side of the lower jaw became loose. Three weeks after the onset, the molar and bicuspid teeth were removed and several pieces of bone came away.

At the time of examination there was an inflammatory mass involving the right side of the lower jaw and the submaxillary region, with considerable induration. There was a granulated area with a discharging sinus in the right side of the lower jaw, inside the mouth, from which the pus could be expressed readily. A roentgenogram of the right lower jaw revealed extensive destruction in the region of the body and ascending ramus (Fig. 46). On account of the extensive destruction and the moth-eaten appearance of the margins of the bone, the possibility of fulminating malignancy was considered, although the history suggested osteomyelitis as the most probable condition.

January 8, 1927, drainage and exploration were done. Tissue was removed for microscopic examination which did not look malignant, and proved

microscopically to be inflammatory. Thorough drainage was established inside the mouth. Drainage on two other occasions in the next two months was instituted, both inside and outside the jaw. Several pieces of sequestrum were

FIG. 46 (Case V).—Extensive osteomyelitis of the right side of the lower jaw with pathologic fracture; very little bone remains on the right side (retouched roentgenogram).

removed, the last one June 27, 1929. The roentgenogram, February 17, 1928, revealed the excellent result of the regeneration of the lower jaw following such an extensive die disease (Fig. 47).

FIG. 47 (Case V).—Regeneration of the right body and ascending ramus of the lower jaw (retouched roentgenogram).

The cause of such a condition as occurred in this case, in the treatment of acute abscesses of the teeth, is usually the

result of attempted removal of a tooth or attempt at drainage too soon after the acute infection has occurred. Not only extensive osteomyelitis of the jaw occurs after such treatment, but frequently general septicemia and death occur. These cases are much better taken care of by using hot compresses and hot irrigations until the acute condition subsides and then establishing drainage. In this particular case the fulminating type of infection simulated a malignant condition on account of the marked moth-eaten appearance of the jaw and the extensive destruction. The excellent result and regeneration of the bone of the jaw is shown in the second roentgenogram. It is best to delay the removal of a sequestrum until sufficient new bone has formed to splint the jaw. If a sequestrum is removed too soon pathologic fracture sometimes occurs. It is sometimes necessary to wire the patient's teeth together in order to protect the newly formed bone until it is strong enough to bear use of the jaw.

FIBROSARCOMA OF THE HYPOPHARYNX

Case VI.—A man aged forty-three years came to the clinic, July 22, 1927, on account of hoarseness and a tumor in the throat of four months' duration. The patient had been continuously hoarse for three months, and had lost 20 pounds in weight. He did not have pain or cough. During the last month he had had dysphagia for solid foods. He was able to swallow liquids without difficulty. He had had no treatment. He had consulted his home physician, who referred him to the clinic.

On examination there was a smooth, round, firm, nonulcerated tumor in the right hypopharyngeal region, so that the right side of the larynx and about half of the left side was not visible (Fig. 48, a and b). The upper part of the tumor was about 3.5 cm. in diameter. It seemed to arise from the right lateral wall and pyriform fossa. It was impossible to determine its depth and extent. There were some large vessels over the surface which gave the appearance of a slowly growing malignant tumor. Roentgenograms of the thorax were negative and the Wassermann reaction of the blood was negative. On account of the short history, it was questionable whether the growth was a highly malignant tumor, or a slowly growing tumor which had not given any symptoms.

It was thought best to do preliminary tracheotomy and then make a biopsy from the laryngeal tumor, the treatment to depend on the pathologic condition. Low tracheotomy was performed August 4, 1927. Biopsy a week afterward proved the tumor to be a fibrosarcoma. Radium was used by means of needles directly into the tumor; 1,200 milligram hours in all. Externally over the neck 3,000 milligram-hours were used with 2 mm. of lead and 2.5 cm. of wood for distance. Considerable local reaction followed this treat-

ment. The tumor, however, gradually disappeared. Treatment by roentgen ray was used outside the neck. The patient was unable to return until August 16, 1929, when there was no sign of the tumor. The tracheotomy tube was removed and the fistula was closed. He had been able to cork the tube, however, for about one and a half years previous to this.

This type of tumor is similar to those seen in the nasopharynx. Microscopically, it is fibrosarcoma, but clinically it is a benign tumor, since it does not metastasize. If it is in the

FIG. 48 (Case VI).—a, Fibrosarcoma of the right hypopharynx; b, drawing two years after preliminary tracheotomy and insertion of radium into the tumor.

nasopharynx it may produce death by direct extension, and if it is in the hypopharynx, as in this case, by causing dyspnea and dysphagia. Radium or surgical diathermy seems to be the ideal treatment for these tumors. Surgical removal is usually associated with considerable bleeding and some mortality. Radium, when used, is best inserted directly into the tumor, and gives excellent results.

MULTIPLE PIGMENTED PAPILLARY NEVI OF THE FACE; PIGMENTED MOLE OF THE FACE; RECURRING EPITHELIOMA OF THE FACE; INFLAMMATORY EPULIS; FIBRO-OSTEOCHONDROMA OF THE MANDIBLE

FREDERICK A. FIGI

MULTIPLE PIGMENTED PAPILLARY NEVI OF THE FACE

Case I.—A girl aged eighteen years came to the clinic May 28, 1928, with multiple, extensive, pigmented, papillary lesions on the left side of the face and scalp (Fig. 49). These had been present since birth, had not recently

FIG. 49.—Multiple, pigmented, papillary nevi of face.

increased in size and were not producing symptoms. The patient wished advice regarding their removal, for cosmetic reasons. Excision, with primary suture and skin graft, was advised.

The patient returned for operation October 24, 1928, and under local anesthesia, the most conspicuous of these lesions was excised. This lesion extended from well up on the anterior portion of the scalp, down over the left side of the forehead, through the brow, and across the inner portion of the upper eyelid, and the root, bridge, and ala of the nose on this side. The por-

tion of the growth on the lower part of the nasal ala was destroyed with diathermy. Microscopically, the lesion proved to be a pigmented, papillary nevus with marked proliferation of sebaceous glands at its base. The margins of the wound following excision were widely undercut and as much of the wound as possible was sutured. A large, denuded area in the frontal region, measuring about 4.5 by 8.5 cm., could not be closed primarily and was covered with a full-thickness skin graft taken from the left side of the abdomen. The graft took perfectly and the remainder of the wound healed nicely. The operative scar over the root of the nose showed some tendency toward the formation of keloid a few weeks later, and an application of radium was given directly over it.

March 4, 1929, the patient returned for removal of the papillary growth on the left cheek, temporal, and preauricular region. Under infiltration anes-

FIG. 50.—Patient (Fig. 49) following excision and full-thickness skin graft.

thesia the lesion was dissected off and the lower and posterior angles of the wound were sutured. A large, triangular area remained, necessitating a skin graft. This was covered with a full-thickness graft taken from the inner aspect of the left thigh. Primary healing of the wound and graft took place with the final result shown in Fig. 50. Some pigmentation of the skin graft on the forehead developed after a few months, but this is gradually fading. However, the area is concealed by the patient's hair so that the pigmentation is of little consequence.

Not only has the patient's appearance improved markedly, but her mental attitude has improved. Removal of lesions of this type is desirable, not only from a cosmetic standpoint, but also because of the danger of epitheliomatous degeneration. Such lesions not infrequently become malignant, even in young persons.

Treatment by irradiation for lesions of this type is unsatisfactory because of their radioresistant character, and the possibility of inducing malignant change. Destruction with the actual cautery, carbon dioxide snow, or electrocoagulation is likely to produce excessive scarring and little cosmetic improvement. Sharp excision is the treatment of choice, since it permits of primary closure of those portions of the wound whose edges can be approximated, and immediate skin grafting of the wider areas. Skin from the inner surface of the upper part of the arm is preferable for grafting on the face, as it is thinner than either that of the abdomen or thigh and bears less hair than that of the thigh. Because of the conspicuous scar following the removal of such a graft from the arm, however, many patients request that it be taken from some other area. There also seems to be a somewhat greater tendency for grafts of thick abdominal skin to become pigmented.

PIGMENTED MOLE OF THE FACE

Case II.—A girl aged twenty years came to the clinic, June 17, 1924, on account of a large, pigmented mole on the left side of the face. This had

FIG. 51.—Pigmented, hairy mole of face.

FIG. 52.—Patient (Fig. 51) following excision and full-thickness skin graft.

FIG. 53.—Outline of area covered with full-thickness skin graft.

been present since birth, but had not produced symptoms. The patient desired removal because of its appearance. Between the ages of seven and eleven years, the lesion had been treated about twenty-five times with carbon

dioxide snow, with some improvement. A year prior to examination in the clinic, an acid had been applied, with the production of areas of whitish scarring.

The lesion was a thick, pigmented, hairy nevus covering the left side of the nose, most of the left cheek, and the outer portion of the upper lip. It was elevated above the level of the surrounding skin, and produced marked disfigurement (Fig. 51). Whitish scarring due to previous treatment was present over the bridge of the nose and the upper part of the cheek, and rendered the lesion more conspicuous. On account of the irregularity of the surface, excision and skin graft in stages was advised. This was done in three operations under local anesthesia at intervals of approximately one month. The skin grafts took nicely; the result is shown in Fig. 52.

RECURRING EPITHELIOMA OF THE FACE

Case III.—A man aged forty-eight years came to the clinic, November 27, 1928, because of an ulcerated lesion in the left frontal and temporal

FIG. 54.—Recurring, superficial epithelioma of face.

region. This had first appeared as a small, elevated growth in the temporal region about twenty years previously. In the course of time it had ulcerated and become progressively larger. Therapeutic measures had consisted of ointments of various types, intravenous injections of salvarsan and exposures to roentgen rays, but these had resulted in only temporary improvement. Examination in the clinic revealed an extensive, ulcerated lesion in the left brow, frontal and temporal regions (Fig. 54). It was about 7 by 9 cm., but in spite of the deep ulceration it had not yet attached itself to the under-

lying bone. Clinically it appeared to be an epithelioma. Biopsy showed it to be a basal-cell epithelioma, and November 29, 1928 wide cautery excision was carried out under local anesthesia. The wound was left wide open, and five days later, after the cauterized margins had been pared and the base curetted in order to remove any devitalized tissue, the entire area was covered with a full-thickness skin graft taken from the inner aspect of the upper part of the left arm. The graft took perfectly so that on removal of the pressure-dressing at the end of ten days, the wound was entirely epithelized. Fig. 55 shows the patient's appearance two weeks after the application of the graft. In a recent letter he stated that there had been no evidence of recurrence of trouble.

FIG. 55.—Patient (Fig. 54) two weeks after excision and full-thickness skin graft.

A lesion of this type might be taken care of by means of electrocoagulation, radiotherapy, or sharp excision. I believe, however, that cautery excision, followed in a few days by a full-thickness skin graft, possesses distinct advantages. Use of the cutting cautery eliminates danger of grafting, and since there is comparatively little bleeding the limits of the lesion can be readily determined and clean removal more easily affected. The technic of destroying such a lesion with electrocoagulation is simple and can be carried out under local anesthesia, but sloughing of the wound results which is extremely slow in healing. The

use of radium or roentgen rays often results, as in this case, in only temporary improvement with subsequent increased activity of the growth. If skin grafting is deferred for several days after excision of the tumor, one is enabled to determine the extent of the cauterization so that the devitalized tissues can be removed readily. In the cases treated in this manner there has been very little bleeding following the débridement, which greatly facilitates suturing of the graft in place and increases its chance of taking. With careful asepsis, quite as high a percentage of takes should be obtained in grafting such areas as in the immediate grafting of fresh, sharply incised wounds. This method of treatment offers the decided advantage of hastening epithelization of a wound which otherwise would be slow in healing, probably requiring several months. Also, the grafted surface withstands trauma quite as readily as normal skin, whereas the tense thin scar resulting from healing by granulation in a wound of this extent remains sensitive for a long time and is easily traumatized. The procedure is, of course, not advisable in cases of active epithelioma or in those in which the limits of the growth cannot be definitely determined and excision cannot be carried widely into normal tissue.

INFLAMMATORY EPULIS

Case IV.—A man aged fifty-four years came to the clinic October 12, 1928, giving a history of having noticed a small, painless, pedunculated tumor on the right lower alveolar process, in the bicuspid area, about fourteen years previously. This was removed surgically within a year but recurred promptly. It was again removed three years later and remained well for five years. Six years previous to the patient's admission to the clinic, the tumor again recurred and two years later was accidentally broken off at its pedicle by a severe blow on the jaw. Further recurrence immediately developed, and during the few months preceding examination in the clinic the growth had increased in size rapidly and had bled at frequent intervals. The patient had no general complaint except for recurring attacks of pain and swelling involving chiefly the upper extremities.

Examination in the clinic revealed a large, pedunculated tumor on the right lower jaw, overlapping both sides of the alveolar process, much like a saddle, so that the pedicle could not be seen (Fig. 56). The tumor extended from the central incisor region well into the molar area, and measured about 2.5 by 3.5 by 4.5 cm. It bled readily on the slightest trauma, and clinically looked like an active sarcoma. Because of its size it interfered with complete

occlusion, and the superior surface bore the imprint of the upper teeth. An enlarged lymph node was present in the submaxillary region on both sides. There was marked dental sepsis. A roentgenogram of the right mandible showed a notched defect in the alveolar border at the site of the tumor, and multiple peridental abscesses (Fig. 57).

General examination showed marked obesity, mild hypertension, umbilical hernia, and an acute inflammatory process involving both hands and both wrists. The last-named condition was diagnosed as acute gout. Following its subsidence the pedicle of the tumor and its attachment on the jaw was coagulated with surgical diathermy, and the growth was lifted off without

FIG. 56.—Inflammatory (irritation) epulis of right mandible.

loss of blood. Two retained dental roots underlying the tumor were lifted out at the same time. Microscopic examination showed the tumor to be a chronic inflammatory granuloma, composed of fibrous connective tissue, and blood vessels. Many plasma cells were scattered throughout the tissue and near the surface of the tumor were polymorphonuclear leukocytes and lymphocytes. The patient has now been free from recurrence for more than a year.

In this case, the long history, the situation, the pedunculated character and previously slow growth of the tumor definitely suggested an epulis. Its recent rapid enlargement, clinical appearance, tenderness, and associated

pain, bleeding on slight trauma, and the enlargement of regional lymph nodes seemed to indicate sarcomatous degeneration. The microscopic picture of chronic granuloma, however, revealed its development as the result of chronic irritation. The marked dental sepsis present, in all probability, was the prime etiologic factor. The acute inflammatory reaction in the tumor undoubtedly accounts for the ease with which bleeding followed slight trauma. Coagulation of the bony attachment of the growth, together with clearing up of the dental infection, should prevent further recurrence.

The roentgenogram is of interest, since the notching of the alveolar process shown is apparently due in part to pressure-absorption resulting from

FIG. 57.—Pressure absorption of right mandible and dental displacement due to inflammatory epulis.

slowly-growing tumor. This same pressure effect is also evidenced by the flaring of the upper portion of the adjacent carious teeth.

FIBRO-OSTEOCHONDROMA OF THE MANDIBLE

Case V.—A married woman aged forty-three years came to the clinic, October 28, 1929, with a recurring tumor of the left lower jaw. A crowned molar tooth had loosened spontaneously and had been extracted about one and a half years previously. Shortly afterward, painless enlargement of the jaw developed at the site of extraction and increased progressively. About nine months prior to examination, this tumor, which had become large enough to produce some external bulging of the cheek, had been removed surgically. Microscopic examination of the tissue was not made at that time. About a month before registration in the clinic the patient noticed recurrence of the tumor, and it had since grown with increased activity.

Examination revealed an extensive uniformly hard, slightly nodular, nonulcerated enlargement of the left mandible, extending from the first bicuspid region to the inner angle, and markedly bulging both the lateral and lingual aspects. All of the teeth in this region were missing. The tumor extended somewhat above the level of the alveolar border, but not to a sufficient extent to interfere with occlusion. There was no local tenderness. The surface of the mass passed so gradually into that of the surrounding normal bone that it was difficult to determine its limits on general examination. Scarring at the site of the previous operative procedure was evident over the surface, which was covered with otherwise normal mucous membrane. There was no enlargement of the regional lymph nodes. The patient was markedly obese. Varicose veins were present in the lower extremities. Roentgenograms of the

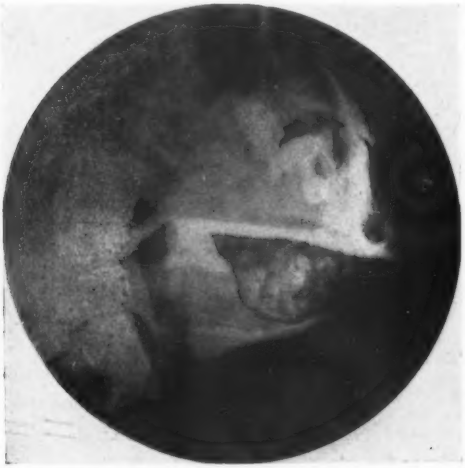

FIG. 58.—Fibro-osteochondroma of left mandible.

mandible showed a large osteogenic tumor involving the upper three-fourths of the horizontal ramus so that only a very narrow bridge of normal bone remained along its lower border (Fig. 58). The roentgenogram of the tumor suggested a benign neoplasm in spite of the history of increased rapidity of the growth. Exploration was advised, and this was carried out under intratracheal anesthesia, October 21, 1929. Biopsy showed the tumor to be a fibro-osteochondroma. Grossly the tumor was of a firm, somewhat elastic or rubbery consistence, and was readily removed with a large curette. Its irregular outline and firm adherence to the surrounding bone, together with the fact that it had destroyed approximately three-fourths of the ramus of the mandible, rendered inadvisable an attempt at removal intact because of the possibility of fracture. Most of the tumor shelled out cleanly, but in areas its line of separation was indefinite and on this account the entire wound

was coagulated superficially by means of diathermy (Figs. 59 and 60). A thin shell of sequestrum will probably form as a result of this cauterization, but the prognosis as regards recurrence and normal function of the mandible should be good.

Tumors of the mandible, other than those of epithelial origin, always present an interesting diagnostic problem. Inflammatory and neoplastic growths, originating in the soft tissues, may at times be of such hardness and so intimately attached to the jaw that only by means of the roentgen ray can their extrinsic

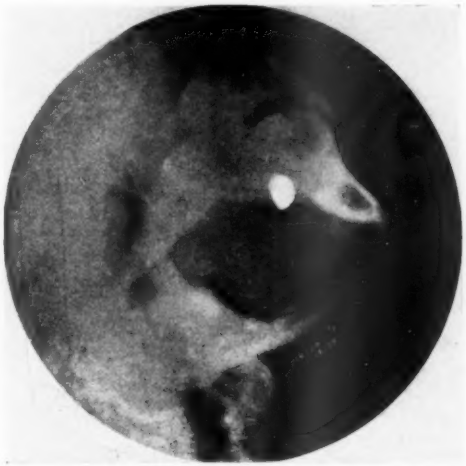

FIG. 59.—After removal of the fibro-osteochondroma of the left mandible (Fig. 58).

character be determined. Actinomycosis and lymph nodes which are involved by metastasis often present such a picture. Besides the tumors common to bones in general, there is a group of specialized neoplasms, originating in dental elements and found only in or about the jaw. Among these may be mentioned the solid and cystic odontomas. Adamantinomas also occur more frequently here, especially in the lower jaw, than in any other portion of the body, but they may develop at the base of the skull in association with Rathke's pouch and in rare

instances, elsewhere. General examination alone may not permit of recognition of these tumors except in the case of certain superficial cystic odontomas and a group of the adamantinomas. The latter often present multiple fluctuant areas, with firm tissue interspersed. The roentgenographic appearance of this group of tumors, however, is diagnostic.

Osteogenic tumors range from the very inactive to the extremely malignant types. A huge osteoma may be present for a number of years and not give trouble aside from the deformity

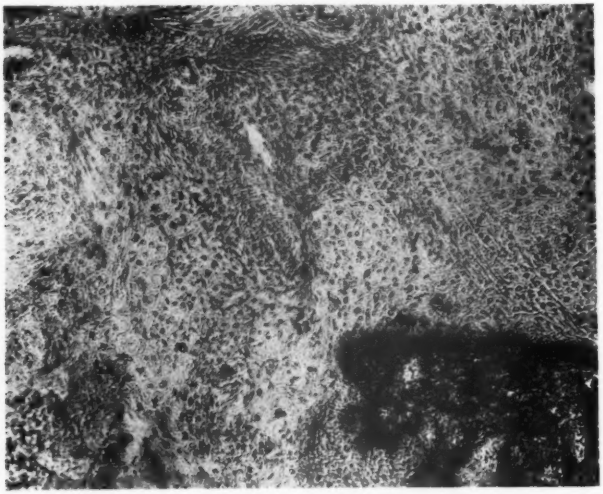

FIG. 60.—Section of fibro-osteochondroma (× 75).

it produces. An osteosarcoma, on the other hand, may attain the same size, within the course of a few months, and also metastasize extensively into the thorax or elsewhere. Often the history is of very little value in determining the activity of such a growth, for the patient will frequently insist that a benign osteoma, that has unquestionably been present for a number of years, has developed only recently. The roentgenogram is of great value in determining whether bone-forming tumors are benign or malignant. Aside from the difference in density there

is a tendency for the spicules of bone, in benign tumors, to arrange themselves longitudinally, that is, parallel with the long axis of the bone, whereas in malignant tumors they are more likely to be arranged irregularly or radially, that is, perpendicular to the long axis. In slowly growing tumors, originating in the bone, there is also a tendency for a shell of increased density to develop about their periphery, but rapidly growing tumors destroy the bone equally in all directions and often present a border that has a moth-eaten appearance.

CARDIOVASCULAR REFLEXES

J. Markowitz and Frank C. Mann

In a previous clinic on the physiology of cardiac resuscitation it was pointed out that the prime essential in resuscitating a dead heart is to provide suitable intracoronary pressure. In order to resuscitate a dog that has been asphyxiated to death it is necessary to give a rapid intra-arterial transfusion. The rate of injection, if possible, should be such as to raise the arterial pressure to about 80 mm. of mercury. It is a distinct advantage to add epinephrine to the transfused medium. The animal in the case represented in the tracing (Fig. 61) was bled to death. When the blood pressure was zero and heart sounds were not heard, the animal was pronounced dead. Eight minutes later, under artificial respiration by means of intratracheal insufflation of air, it was given an intra-arterial transfusion of 500 c.c. of heparinized blood containing 1 c.c. of solution of epinephrine 1 : 1,000. The dog weighed 20 kg. The transfusion, as may be seen in the tracing, raised the blood pressure, but failed to cause the heart to start beating. A ureteral catheter lubricated with petrolatum was then passed down the jugular vein into the superior vena cava and the blood was siphoned off. This blood was repeatedly transfused intra-arterially under pressure. The object of draining the superior vena cava is to prevent overdistention of the right side of the heart. A distended heart is more difficult to resuscitate and the survival period of a once distended heart, when perfused outside the body with Locke's solution, is distinctly less than normal.

In spite of the fact that the blood had been circulated three times in this manner, the heart failed to resume its beat. At this point, the trick was adopted of causing the blood to circulate by rhythmic compression of the animal's sternum about

thirty times a minute. Such manipulation has a decided influence on the animal's circulation. All the valves of the circulation are so arranged that compression of the thorax expels blood into the arteries and relaxation of the thorax sucks venous blood into the thorax. It can readily be seen that considerable circulation of blood can be accomplished in this manner in the absence of any heart beat. When the technic was employed of rhythmically compressing the sternum during the transfusion, the blood pressure rose, and in a little while the heart began to beat. As Fig. 61 shows the blood pressure soon rose over the normal value. Fifteen minutes after the successful resuscitation of the circulation, the dog began to breathe in a

FIG. 61.—This tracing illustrates the resuscitation of the circulation of a dog that has been bled to death through the femoral artery. The blood has been collected in a solution of heparin, which is an anticoagulating substance prepared from the liver according to Howell's method. The time marker represents intervals of four seconds. The base line represents zero blood pressure. An intra-arterial transfusion was given where the tracing indicates "perfusion started." To conserve space the drum was stopped for five minutes. The blood was syphoned out of the right side of the heart by a ureteral catheter. In all, the heart was quiescent for more than half an hour before it resumed its beat.

gasping fashion and in another half hour the respirations were sufficiently spontaneous to enable us to discontinue artificial respiration. The corneal reflex reappeared.

QUESTION: The tracing is labeled cardiac massage. Does this mean the rhythmic compression of the sternum?

ANSWER: Yes. The term cardiac massage is loosely employed and it is doubtful if cardiac massage as such actually accomplishes any more than rhythmic compression of the thorax in causing circulation of blood in and out of the thorax. Theoretically the ideal way to resuscitate a heart would be to pass an electrode over the sinus node and stimulate it with induction shocks eighty times a minute. This is quite feasible when the thorax is open, but probably it is not so practicable when the thorax is intact.

QUESTION: Schäfer's method of artificial respiration would accomplish the same as your traction of the sternum, would it not?

ANSWER: Yes. There can be no question that by far the best way of giving artificial respiration is by Schäfer's method since it not only circulates air in and out of the thorax, but also pumps blood in and out of the thorax. Occasionally, Schäfer's method is inapplicable, as in cases in which the respiratory passages are obstructed. It is not uncommon in dogs for the epiglottis to become impacted against the false vocal cords so that the trachea has to be intubated to allow free access of air.

QUESTION: Then why are you using intratracheal insufflation as a means of artificial respiration in your experiments?

ANSWER: Only because it is convenient. It also provides a means of maintaining an extremely uniform grade of ether anesthesia since the ether gets to the pulmonary epithelium irrespective of the state of the animal's breathing. Later, we shall demonstrate some cardiovascular reflexes. The subject is by no means thoroughly worked out but enough material has accumulated during a period of more than eighty years to make the consideration profitable. The subject will be presented rather diagrammatically. It is often impossible to elicit a single reflex by itself. The interrelationship is so highly developed that a stimulus to one nerve, instead of eliciting one response, may bring forth a number of reactions which may make analysis of an individual response difficult.

Cardiovascular reflexes are chiefly concerned with maintaining proper intra-arterial, intravenous, and intracardiac pressure. By far the most important of these is the maintenance of suitable intra-arterial pressure.

QUESTION: Why is it important to have suitable intra-arterial pressure?

ANSWER: First the heart fails to get adequate circulation through the coronary system when the intra-arterial pressure is low. Second, the centers in the medulla, and to a lesser extent higher up in the brain, are easily injured by the deficient flow of blood, which results from low arterial pressure. Third, it has been shown rather recently that the permeability of capillaries is markedly increased by asphyxia of these structures. When the capillaries of a frog are perfused with oxygen-free Ringer's solution the permeability for fluid is many times the normal. When the arterial blood pressure is low, the amount of blood circulating through the tissues each minute is considerably less than it should be and the tissues become asphyxiated. A vicious circle could readily be set up in this manner. All are familiar with the concentration of blood that occurs in surgical shock, whatever its cause. The low blood pressure is, therefore, serious to the heart, to the central nervous system, and to the tissues. In each of these the tendency of a low blood pressure is to start a vicious circle. There is, however, one more function to blood pressure. Up to now it has been taken for granted that the only function of blood pressure is to provide to the tissues a definite quantity of blood for each unit of time. There may be other advantages in having blood offered

to the tissues at a definite pressure: The oxidation potential of the oxygen is probably much greater when the oxygen is offered to a tissue at a definite pressure head; also, diffusible foodstuffs probably leave the capillaries much more rapidly when the blood pressure is not low.

On the table before us is an etherized albino rabbit. Its ears have been shaved. The carotid artery is connected to a mercury manometer and the connecting tubing is filled with an anticoagulating solution. In small animals like rabbits, it is better to employ a solution of heparin. Alongside the carotid artery are two slender nerves and one stouter one. The stouter

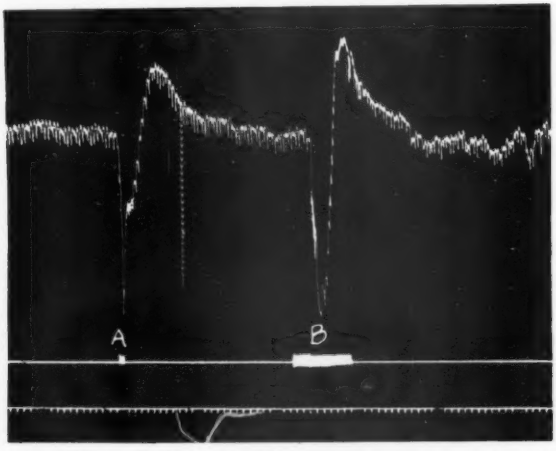

FIG. 62.—Effect of stimulation of the vagus nerve on the blood pressure of a rabbit. At *A* the vagus nerve was stimulated with a strong faradic current. At *B* the current was weakened. It will be noted that during continuous stimulation the heart resumed its beat; this phenomenon is known as vagus escape. The time marker records every five seconds. The signal marker is also the zero base line. This arrangement is identical in all subsequent tracings.

one is undoubtedly the vagus. The two slender ones are the cervical sympathetic and the so-called cardiac depressor nerve. We shall stimulate each of these in turn electrically and observe what happens.

We are now stimulating the left vagus nerve. There is a prompt fall in blood pressure (Fig. 62). The heart has ceased

to beat for two seconds, as is indicated by the fact that the writing needle is not oscillating. As the stimulation continues the heart gives an occasional beat and the blood pressure is recovering in spite of continuous stimulation. The heart is now beating at a rate which is slower than normal and the blood pressure is almost back to normal. This action of the vagus nerve was discovered by the Weber brothers in 1845. The resumption of the heart beat in spite of continuous stimulation of the vagus nerve is called vagus escape. At the time the Weber brothers announced their discovery it was received with incredulity because it was incomprehensible that stimulating a nerve could inhibit the muscle. All previous experiences had indicated that stimulating a nerve caused a muscle to contract and until recently this peculiar action of the vagus nerve has received no explanation. It is now supposed from the work of Loew and others that the vagus nerve does not act directly on the cells of the heart muscle, but that it functions indirectly by liberating a hormone in the heart, the function of which is to stop the heart. In other words, inhibition of the heart is brought about by a drug and not by a nerve impulse.

Pilocarpine, physostigmine, digitalis, choline, and more especially its acetyl derivative, acetylcholine, will act to slow or stop the beat of the heart. We want to give the evidence that the action of the vagus nerve is to liberate a compound in the heart muscle, the function of which is to slow or stop the beat of the heart. A frog or turtle heart is perfused with Ringer's solution by means of a cannula in the aorta, and the branches of the aorta between the cannula and the heart are tied. The apex of the heart is cut and the Ringer's solution is collected. This Ringer's solution is perfused through a similar frog or turtle preparation. The two hearts are said to be perfused *in tandem*. The vagus nerve of the first frog is stimulated in the neck. The fluid that drips from the heart during this period of stimulation will slow or stop the beat of the heart of the second frog. The experiment may appear rather artificial, but it should be pointed out that this vagus hormone is unstable in blood, and rapidly disappears in this medium, so that in about fifteen seconds a

considerable quantity of it may be completely lost. The experiment is easy to repeat and proves conclusively the existence of a vagus hormone. It might be stated parenthetically that such experiments justify the use of lower forms of life in physiologic research, since such an experiment is much more difficult to carry out on a mammal.

In view of the fact that acetylocholine has all of the properties of this vagus hormone, it is being assumed that the vagus hormone is actually acetylcholine. Since choline is universally present in living tissues, especially in nerves, it would seem that this assumption is justified. Recently, Dale and Dudley isolated chemically pure acetylcholine in large quantities from the spleen. We venture to predict that within a few years acetylcholine will have many uses in clinical practice.

QUESTION: If acetylcholine is injected intravenously, would the effect on the heart be the same as stimulating the vagus nerve?

ANSWER: Yes. This is demonstrated by injecting into this rabbit 0.05 Mg. of a fresh solution of acetylcholine. The effects are identical even with regard to vagal escape.

The vagus nerve has many fibers in it, some going to the viscera (efferent) and some going to the brain (afferent). This is demonstrated by cutting the vagus nerve, and stimulating the cephalic end (Figs. 63 and 64). The great rise in blood pressure, and also the effect of the animal's respirations, may be noted. They become deeper and slower; often they stop. Evidently, then, the vagus nerve contains fibers going to the head which on stimulation raise the blood pressure. By serially removing various portions of an animal's brain, it can be shown that the effect is produced by the vagus nerve acting on a portion of the floor of the fourth ventricle, the so-called vasomotor center. It also contains afferent fibers for the respiratory center.

Attention is now directed to the other two nerves. One nerve is picked up and stimulated electrically. The blood pressure is rising. It is evidently not the so-called cardiac depressor nerve, and must, therefore, be the cervical sympathetic nerve. All are familiar with the cervical sympathetic nerve in the

FIG. 63.—Effect of stimulation of the cephalic end of the left vagus nerve in a rabbit; both vagus nerves have been cut; there is a marked rise in blood pressure.

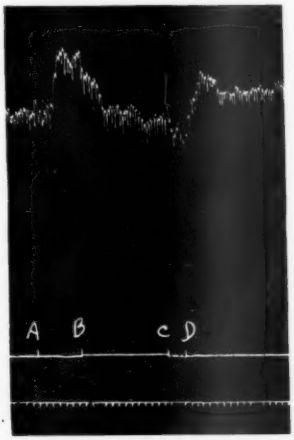

FIG. 64.—Effect of tying and cutting the right and left vagus nerves, respectively, on the blood pressure of a rabbit. At *A* and *B* the right vagus nerve was tired and cut. At *C* and *D* the left vagus nerve was tied and cut. In each case there is a temporary rise in blood pressure. This rise is usually attributed to the accelerated heart rate which follows section of the vagus nerve.

human being which lies dorsal to the carotid sheath and in front of the longus capitis and longus colli muscles. If the ears of this rabbit are held up to the light, some idea will be obtained as to the function of this nerve. It may be seen that as the cervical sympathetic nerve in the neck is stimulated the corresponding ear becomes paler than the opposite ear. The number of vessels distinctly visible is much less. It may be noted, also, that the pupil of the corresponding eye dilates on stimulation. The nerve is now cut. The vessels in the corresponding ear are widening. The ear is distinctly redder and the number of visible vessels is much greater. It may be concluded that one function of the cervical sympathetic nerve is to regulate the caliber of the vessels in the head and face. The nerve is continuously constricting these vessels; that is, these vessels are continuously receiving tonic constrictor impulses from the vasomotor center by way of the cervical sympathetic nerve. The nerve has an interesting history. It was discovered by Claude Bernard in 1852. By means of just this experiment it has been shown that surgical shock is not due to exhaustion of the vasomotor center. In a rabbit that is deeply shocked it is possible to show that section of the cervical sympathetic nerve still results in considerable vascular dilatation of the corresponding ear.

The third nerve is the cardiac depressor nerve. It should be called simply the depressor nerve. The term "cardiac depressor" implies that it depresses the heart, which does not mean anything. The nerve is afferent, beginning largely in the aortic arch and coursing upward to the vasomotor center. The name "cardiac depressor" was given to it because of the mistaken notion that it originated in the walls of the heart. As a matter of fact, very few of the fibers arise in the heart. It is a special case of universal sensory innervation of blood vessels, and it can be shown that reflexes similar to that manifested by the depressor nerve can be obtained from more peripheral vessels.

In stimulating the depressor nerve (Fig. 63) marked fall in blood pressure may be noted. This fall in blood pressure occurs even after both vagi are sectioned. It is a peculiarity of this

effect that it does not appear to be susceptible to fatigue. The depressor nerve can be stimulated over a period of many minutes with nonpolarizable electrodes, and as long as the nerve is stimulated the blood pressure remains low. It is important that this should be so. Obviously the function of the depressor nerve is to act as a safety valve for the aortic arch, to prevent in it the development of too great pressure in the event of the cardiac discharge being unusually large. Such function might have to be exercised for a long period of time.

FIG. 65.—Effect of stimulation of the cardiac depressor nerve on the blood pressure of a rabbit. Both vagus nerves were cut in the neck previous to the stimulation.

We thus have examples of two nerves coursing upward to the medulla. One nerve, the afferent vagus, on stimulation, is followed by a rise in blood pressure; the other nerve, the depressor, is followed by a fall in blood pressure. That the cervical sympathetic and depressor nerves are coursing upward to the head almost exclusively can be readily shown by cutting them and stimulating each end. An effect is obtained only on stimulating the portion going to the head.

It is of interest to see if the depressor nerve is exerting tonic inhibitory impulses on the vasomotor center.

If this were a fresh rabbit and had not been subjected to an hour's etherization, it might be demonstrated that cutting the depressor nerves is followed by a rise in blood pressure. This is easier to demonstrate if the blood pressure is first raised by a transfusion. In fact, one theory for essential hypertension in the literature today is that it is due to disease of those nerves that begin in the walls of blood vessels and course upward to the

FIG. 66.—The reverse experiment of pulling on *A*, and tying *B*, the right common carotid artery. Traction on the cardiac end of the right carotid artery results in a fall in blood pressure. Presumably this is due to stretching the nerve endings in the carotid sinus. Conversely, ligating the common carotid is followed by a considerable rise in blood pressure, presumably due to a reflex from the nerve endings in the carotid sinus. This rise in blood pressure is considerably less when the sinus is first denervated by stripping of the adventitia.

vasomotor center in the medulla. The depressor nerve is the best known example of such a structure. Recently Hering described a branch of the glossopharyngeal nerve which begins in the carotid sinus. As many be remembered, the carotid sinus is the bulbous expansion of the common carotid artery just before its division into the internal and external carotid arteries.

From an embryologic point of view it is logical to expect

that those structures having a similar origin should have a similar innervation*; and this is the reason no doubt why the carotid sinus is as thoroughly protected from overdistention as is the aortic arch. When the carotid sinus is distended by any of several means, the blood pressure promptly falls, and conversely, when the carotid sinus is emptied by ligature of the common carotid artery the blood pressure promptly rises (Figs. 66 and 67). Similarly, the blood pressure rises when the carotid

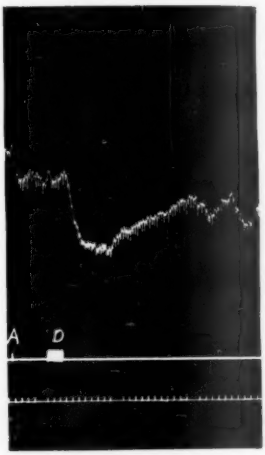

FIG. 67.—In this experiment the right carotid sinus of a rabbit was stimulated electrically at *A* and *B*. The stimulation was more effective at *B*. Marked fall in blood pressure is noted. The vagus nerves and cardiac depressor nerves on each side have been sectioned.

sinus on each side is denervated by stripping the adventitia thoroughly of its nerves. When this is done aseptically in rabbits and when also the depressor nerves are severed, a type of chronic hypertension develops accompanied by cardiac hypertrophy and

* The aortic arch on the left side, and the innominate and proximal part of the subclavian on the right, are derived from the fourth aortic arch embryologically. The ventral stems between the third and fourth arches form the common carotid arteries, and those between the third and first form the external carotid arteries, whereas the internal carotid arteries are formed by the third arches and the dorsal stems between the third and first arches.

arteriosclerosis (Nordmann). It may be that the clinical condition of essential hypertension is, in some cases, the result of neuritis involving those nerves that course from the arteries to the vasomotor center, and the function of which is, by suitable depressor reflexes, to prevent overdistention of the arterial lumen from too high a blood pressure.

It should be stated that in the majority of animals, perhaps including man, the depressor nerve is not a separate structure but is bound up in the sheath of the vagus. It is fortunate for physiologic reasons that the nerve is separate in the rabbit, for otherwise it would have been difficult to analyze its functions with assurance. In a dog, stimulation of the cephalic end of the cut vagus usually provokes a rise in blood pressure, but by varying the strength of the stimulus, results are obtained that are quite comparable to those that occur after stimulation of the depressor nerve in the rabbit.

KERATOMA: A LESION OFTEN MISTAKEN FOR SEBACEOUS CYST

ALBERT C. BRODERS AND ELIZABETH WILSON

THE pathologic entity which usually passes under the terms "wen" and "sebaceous cyst," is not usually a sebaceous cyst, but a keratoma. In the usual text-book descriptions of wens and sebaceous cysts, it is stated that they are retention cysts

FIG. 68.—Keratoma showing lamellated arrangement of keratin and worm-eaten effect from degeneration.

of the sebaceous glands, formed by blocking of the ducts. They are lined by squamous epithelium and are said to contain sebaceous material, a soft grumous substance containing fatty granules and cholesterin crystals. When a true sebaceous cyst is opened, there emanates from it an odor not unlike that given off by limburger cheese.

However, the keratoma presents a different picture. Unless it is infected or badly degenerated it is practically odorless. Keratoma, especially that of the scalp, commonly called a wen, on cross section presents a lamellated effect (Fig. 68). As a result of partial disintegration, it often has a worm-eaten appearance. We believe that the content of a keratoma is keratin

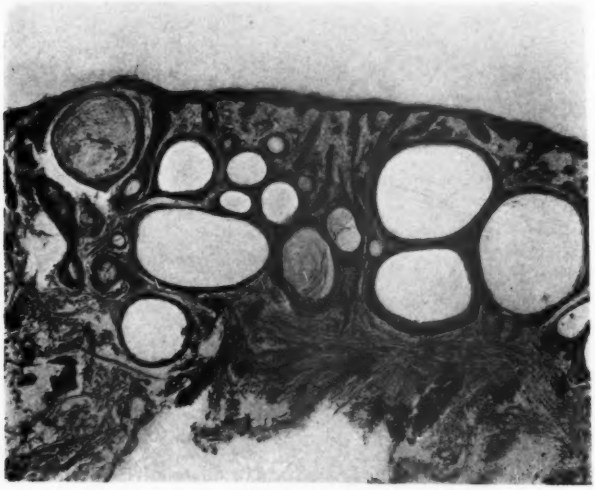

FIG. 69.—Multiple keratomas of forehead (× 25).

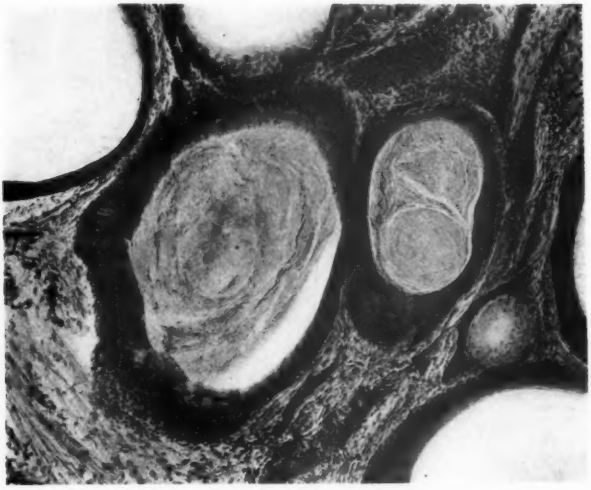

FIG. 70.—Multiple keratomas of forehead (as shown in Fig. 69) composed of a squamous-cell epithelial periphery and a keratin center (× 100).

for the following reasons: (1) When a piece of keratoma is burned, it gives off an odor like that of burning hair, wool, or feathers; (2) this substance does not rise to the surface of water as fatty substances do, for example, the contents of dermoid cysts, true sebaceous cysts, or of adenomas of the sebaceous glands; furthermore, it is not greasy to the touch and is easily washed from the fingers with cold water; (3) the microscopic appearance of keratomas is duplicated in the epithelial pearls of squamous-cell epitheliomas, whereas metastasis in lymph nodes from a low-grade squamous-cell epithelioma often bears a close macroscopic resemblance to degenerated keratoma; that is, the lesion has a worn-eaten appearance, and (4) any fatty granules and cholesterin crystals present in keratomas are probably the result of degeneration. Cholesterin crystals are frequently found in keratinized crypts of tonsils, far removed from any sebaceous glands.

Microscopically, the keratoma is made up of keratin throughout, except on the periphery where the partially differentiated and undifferentiated epithelial cells are found (Figs. 69 and 70). The lamellated arrangement of the keratin is sometimes preserved, but frequently the central part falls out, giving the appearance of a cyst.

SUGGESTED ETIOLOGY

As far as we were able to determine, a keratoma has its origin in the duct of a sebaceous gland. This suggestion is supported by several observations.

1. The normal sebaceous gland has two types of epithelium. The cells of the gland proper normally become filled with fat droplets, then disintegrate, forming an oily substance, sebum. In the ducts, on the other hand, there is stratified squamous epithelium which differentiates into keratin. From their structure, therefore, it would seem more reasonable that keratomas should be derived from the ducts.

2. If skin from the face is examined, plugs will frequently be found in the ducts with a structure resembling keratoma, even though the duct is partly open at the top.

3. The sebaceous glands so obstructed, and the fact that sebaceous glands in the region of keratomas show little change, suggest that the glands do not continue to secrete in the face of such obstruction.

4. The more common occurrence of these tumors in older persons, when the sebaceous glands are less active, and keratinization is increased, would suggest that they occur more readily when the ducts are not flushed out by the products of the sebaceous glands, thereby favoring the accumulation in them of more keratin.

5. When such tumors become malignant they are squamous-cell epitheliomas and not adenocarcinomas.

Keratomas may occur singly or in groups. Many individuals show a predisposition to the development of keratoma. The keratomas vary from microscopic size to 12 cm. in diameter. The small white spots seen on the faces of many persons show an identical structure, but rarely reach large size. In younger persons the regenerative epithelium of larger keratomas sometimes appears more active than usual.

SUMMARY AND CONCLUSION

True sebaceous cysts contain a fatty material which gives off a strong odor. Keratomas, on the contrary, unless infected or badly degenerated, are practically odorless. Many lesions diagnosed sebaceous cysts or wens clinically, when examined microscopically, are found to be made up for the most part of keratin and not sebaceous material. There is considerable evidence to support the belief that these lesions are tumors that arise in the ducts of the sebaceous gland rather than from the sebaceous gland proper. For such tumors we believe that keratoma is a more accurate term than sebaceous cyst.

THE IMMEDIATE RESPONSE OBSERVED IN THE TREATMENT OF CASES OF CARCINOMA OF THE CERVIX UTERI WITH RADIUM

HARRY H. BOWING

IT is not surprising to report good results in cases of carcinoma of the cervix uteri treated with radium and roentgen rays. The therapeutic rays of radium applied to the field of primary carcinoma, supplemented by high-voltage roentgen ray, offer much in the way of palliation to the average patient seen today, and probable cure of the few patients observed in which the lesion may be classified as operable or borderline.

Brief reports of three cases are presented to illustrate the immediate or initial response observed in a small group of unselected cases during treatment with radium (Figs. 71, 72, and 73).

Broken doses and an intensive method in the application of the radium rays has much to commend it in the treatment of this disease. It furnishes the best method of meeting the individual needs of the patient, an all-important factor in treatment with radium. As yet, it is clinically impossible to select patients who are decidedly sensitive in reaction from those in whom the response seems sluggish or retarded. This method is not the simplest to apply; on the other hand, it is tedious for both patient and radiologist. It is essential to know what factors in treatment to employ in the initial applications as well as in the subsequent courses; further, it is highly important to estimate, from time to time, the response obtained from the previous applications. In a general way, the observation of the patient may help to estimate this response. A satisfactory report usually contains statements regarding diminution of the amount of vaginal discharge and any change in its character. The bleeding and odor will disappear, and, in many instances, the

distressing backache and unilateral pains in the leg will be greatly ameliorated and may cease entirely following the initial applications. This immediate effect is gratifying and stimulating in that the patient responds with willing coöperation. When the factors of treatment are correct and the interval between applications is properly timed, it will not be necessary to encourage the patient to continue with the course. As a rule, when the general response is satisfactory, the local response is also gratifying. The latter can be estimated to the fullest degree by inspection of the field of treatment. This is best accomplished with the patient in the knee-chest position and with the use of the Sims' speculum and some type of direct light. The knee-chest position also is excellent in placing both the radium applicator and the gauze packing in the vaginal cavity. The medullary, bulky, cervical carcinomas gradually diminish in size, lose the typical gross appearance of a malignant lesion, and ulceration and necrosis are not noted as effects of treatment. When these pernicious features are found before treatment is applied, as a result of the destructive processes of the disease, they should heal gradually and pass away with the concomitant disappearance of the odorous, sanguineous vaginal discharge. The bulky, fixed infiltrations which occur in the primary site, in the vaginal walls, and in the regions of the broad ligaments will diminish in size. However, their response is slower and more complete following the usual interval of three months which is allowed at the end of the course.

The patients are hospitalized for a twenty-four-hour period before the radium is applied. Surgical technic is used in placing the radium. The field of treatment is prepared with a warm water douche before the patient is brought to the operating room. With the patient in the knee-chest position the vaginal cavity is further cleansed with gauze sponges. An aqueous solution of mercurochrome 2 per cent in liberally applied to the malignant area and to the adjacent walls of the vagina. However, in the case of much necrosis and ulceration, alcohol (50 per cent) is applied preceding the solution of mercurochrome.

Every care is taken to avoid unnecessary trauma to the

region of cervical infiltration; therefore, the mechanical manipulation necessary to prepare the field and to place the applicators is delicately carried out.

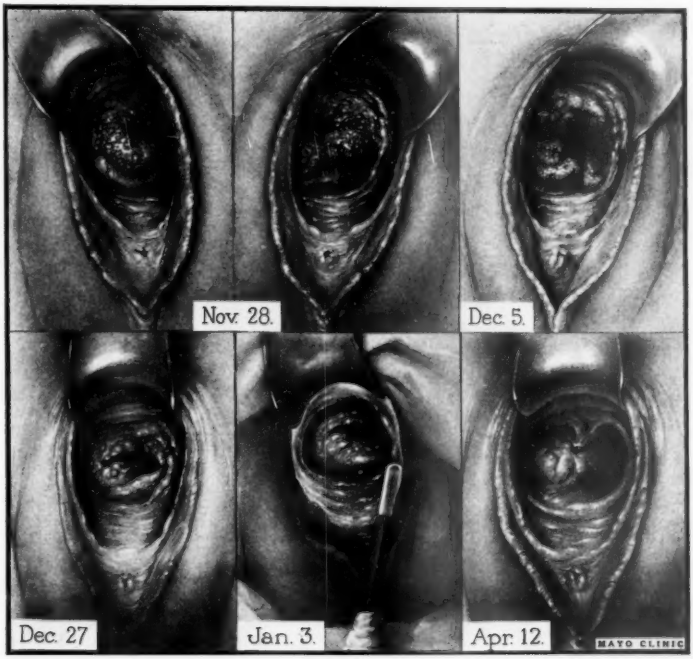

FIG. 71 (Case I).—Radium was applied first November 28 and last January 3. The ulceration and decay present when the patient was first seen gradually disappeared during the course of treatment. The lesion healed as shown in the drawing (April 12), with only slight contraction of the vaginal walls. The size of the vaginal cavity approached normal. The uterus was small, in normal position and freely movable.

The classification of the cases and the method of designating the technic of radium treatment to be employed are similar to those reported elsewhere.[1] The reports of cases and comments

[1] Bowing, H. H., and Fricke, R. F.: Radium in the treatment of carcinoma of the cervix uteri during 1927. Am. Jour. Roentgenol. and Radium Therap., 1929, xxi, 529–537.

are necessarily brief. The sketches were made at the time of application of radium and at intervals of five to seven days during the course of treatment. Sketches were made also at the end of the usual interval of three months following the last application of radium.

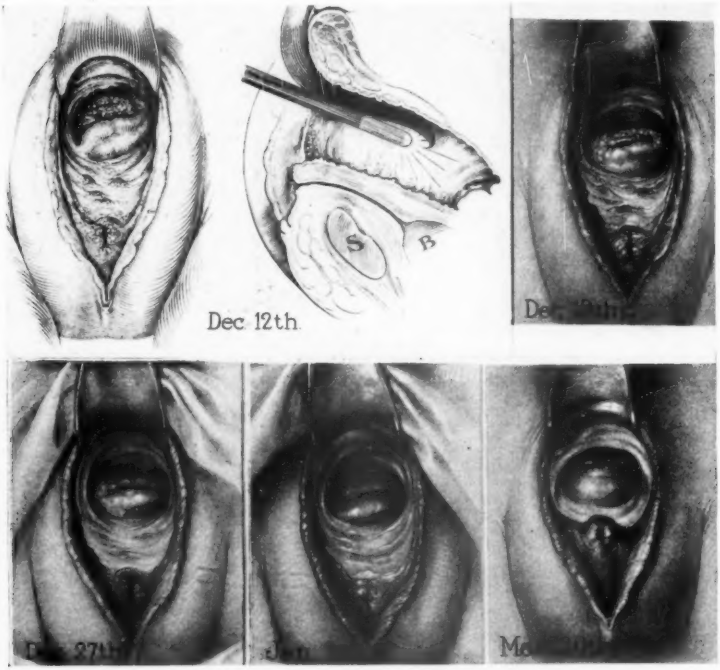

FIG. 72 (Case II).—The first application of radium was made December 1 and the last January 2. The multiple infiltrations of the walls of the vagina were unusual, and responded satisfactorily, healing slowly, without necrosis or ulceration. Examination, March 20, did not reveal any gross pelvic activity. The tissues about the external urinary meatus appeared normal.

It is impossible to expose the lesion adequately in one field, so liberties have been taken in making the drawings (Figs. 71, 72, and 73). Two methods were employed. In one instance the retractor is shown in the drawing; however, the amount of

retraction is exaggerated to help illustrate the extent and situation of the primary lesion, whereas in other cases the line drawings furnish the relationships, and cross bars are used to assist in evaluating the enlargement of the field of treatment.

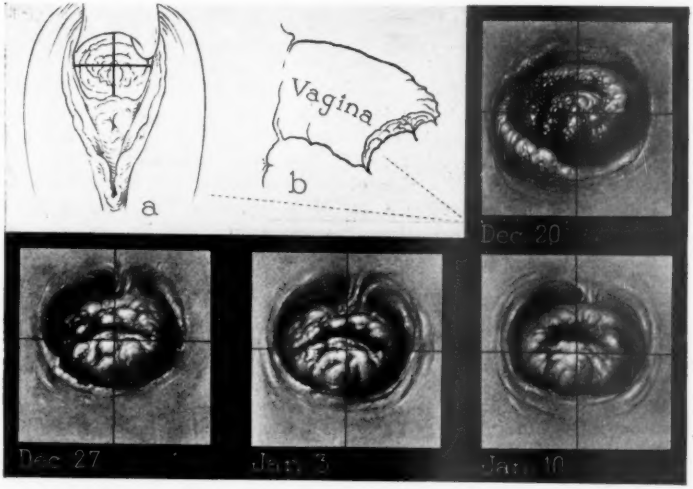

FIG. 73 (Case III).—Sketches *a*, *b*, and December 20 were made the day of the first application of radium; the other three sketches were made December 27, January 3, and January 10, respectively. The gross malignant appearance gradually faded away without any sign of further necrosis or sloughing, a highly desirable feature of the method of application of radium in individual broken doses.

REPORT OF CASES

Case I.—The condition of a woman, aged thirty-nine years, had been diagnosed clinically as inoperable carcinoma of the cervix uteri. The pathologic diagnosis made from a bit of tissue removed was of squamous-cell epithelioma, graded 2. The patient stated that she had had menorrhagia since a miscarriage one year before. There had been a profuse, watery, yellow discharge for the last three or four months. Recently she had had several severe vaginal hemorrhages and of late she had been having pain low in the abdomen. Her general health was good aside from severe secondary anemia. Bimanual pelvic examination revealed a large, infiltrating cervical tumor, with extensive involvement of the adjacent structures; thus the vaginal cavity was nearly filled. Typical fixation of the broad ligament could

not be determined. The uterus and infiltrated tissues seemed movable. Moderate bleeding and much odor were present.

A complete treatment with radium was begun November 28; a total of 8,440 milligram-hours and millicurie-hours was given in eleven applications. The intervals between treatments varied from three to seven days. All applications except the intra-uterine treatment were made with the universal monel tube applicator containing 50 mg. of radium sulphate (element); the walls of the tube of monel metal were 1.5 mm. thick. Four treatments were given within the cervical infiltration, about in the central portion, and each application remained in position for fourteen hours. The same tube was placed in the anterior and middle portions of the crater present in the region of cervical infiltration. The time of each application was fourteen hours. Ten monel needles, containing 5 mg. of radium sulphate (element), were buried in the infiltrated area, about 1 to 2 cm. apart. The time of treatment was twelve hours. A tandem applicator containing 110 millicuries of radon, with provision for filtration through 0.5 mm. of silver and 1 mm. of brass, was introduced into the uterine cavity and allowed to remain in place for fourteen hours. The usual vaginal applicator was placed across the vaginal culdèsac and in the right and left vaginal fornices for a period of fourteen hours in each place. Separate applications were made in each region mentioned.

The course of radium treatment was followed by the application of high-voltage roentgen rays. The following factors were employed: kilovolts, 200; milliamperes, 5; distance, 50 cm.; filtration through copper, 0.75 mm., aluminum, 2 mm.; time, one and a fourth hours to each of four areas, anterior, posterior, and two lateral fields. One area each day was treated until all had been exposed.

The patient returned the following April, and at that time, the field of treatment was free of gross, active carcinomatous infiltration. Her general health was good. Menopausal complaints were moderately distressing. The usual second course of high-voltage roentgen-ray treatment was given with the employment of the same factors as those mentioned.

This case is reported as an example of a typical inoperable carcinoma of the cervix, with an extensive ulcerating lesion and marked secondary anemia due to hemorrhage. The course of treatment with radium was necessarily lengthened and the total dose was greater than the average. The patient's convalescence was uneventful. The initial response and the result noted at the end of the interval usually allowed were exceptionally satisfactory.

Case II.—The case of a woman aged forty-seven years had been diagnosed as inoperable carcinoma of the cervix uteri. Surgical biopsy was done, and the pathologist reported squamous-cell epithelioma graded 2. The patient

had noticed bleeding after coitus for the last two years. There had been occasional intermenstrual "spotting." Vaginal bleeding had occurred with straining at stool for the last several months. There was no pain. Her general health was good. Bimanual pelvic examination disclosed medullary cervical infiltration with regional involvement of the walls of the vagina. There were also multiple small areas of induration throughout the wall of the vagina. The tissues about the external urinary meatus were thickened and distorted. The fundus was normal in size, anterior in position, and movable. Rectal palpation revealed a cervical tumor in the median line about 6 cm. in diameter; infiltration of the broad ligament was not found. There were rather definitely enlarged inguinal lymph nodes on both sides. A complete radium treatment totalling 5,508 milligram-hours and millicurie-hours was begun December 1. Ten treatments were given at intervals varying from two to seven days. The monel tube applicator used in Case I was placed in the anterior cervical region, on two occasions, for a period of eight hours each. The same applicator was placed in the middle cervical region on two occasions for the same period of time. One tandem intra-uterine applicator containing 126 millicuries of radon was placed deep in the uterine cavity for a treatment eight hours in duration. Filtration was through 0.5 mm. of silver and 1 mm. of brass. The vaginal applicator used in Case I was placed across the region of the vaginal culdesac and in the longitudinal axis of the vagina in the deep, middle, and anterior divisions of the vaginal cavity. These vaginal applicators were in place for fourteen hours each, with the exception of the anterior one which was in position for twelve hours. The last treatment consisted of the placing of ten platinum iridium needles containing 1 mg. of radium sulphate (element) in the region of infiltration near the vaginal outlet and external urinary meatus. The time of application was twenty hours.

The treatment of radium was followed by a course of high-voltage roentgen-ray treatment, employing the same factors as those mentioned in the report of Case I.

At a visit in March a second course of high-voltage roentgen-ray treatment was given, employing the same factors as those previously mentioned, except that each field was exposed for one hour and ten minutes.

The extent of involvement by the primary growth was not great, and therefore the time of treatment was reduced. With the patient in the knee-chest position multiple regions of metastasis throughout the walls of the vagina were readily seen. They proved to be numerous, and, accordingly, palliation only was expected. The widespread involvement proved to be sensitive to the therapeutic rays of radium, and the initial response, as well as the improvement noted at the visit the following March, was satisfactory. At that time there was no gross evidence of malignant disease. The mucous membrane of the

vagina was intact, and the tissues about the external urinary meatus seemed normal.

Case III.—A woman aged forty-eight years was suffering from a condition that had been diagnosed as extensive carcinoma of the cervix uteri, and a bit of tissue removed at the time of the first application of radium proved to be a squamous-cell epithelioma, graded 4. There was a history of leukorrhea for four years, and for the last three months there had been a serosanguineous and malodorous discharge. The patient had lost 10 pounds in the six weeks before she came to the clinic.

Bimanual pelvic examination revealed an extensive infiltrating cervical carcinoma, with marked involvement of the wall of the vagina. The lesion was annular, and more marked on the left side. By rectal examination, infiltration in the left broad ligament, graded 2, was found. Complete radium treatment was begun December 20, namely, a total of 5,106 milligram-hours and millicurie-hours in nine applications. The interval between treatments varied from three to seven days. The tube applicator was used, as in Case I, and was placed in the anterior portion of the cervical canal on two occasions, once for ten hours and once for eight hours. At the second treatment, three monel needles, containing 5 mg. of radium sulphate (element) were buried in the anterior cervical lip area for eighteen hours. A universal tube applicator containing 62 millicuries of radon with provision for filtration through 0.5 mm. of silver and 1 mm. of brass was placed in the midcervical region for eight hours, and the second application to this same area was by a similar tube containing 56 millicuries of radon, and the time of treatment was the same. The tandem intra-uterine applicator contained 80 millicuries of radon and was permitted to remain deep in the uterine cavity for twelve and a half hours. The vaginal applicators mentioned in Case I were applied in a similar way. The time of treatment was also fourteen hours with each applicator.

The radium treatments were followed by a course of high-voltage roentgen-ray treatment, using the same factors as in Case I. In addition, however, a fifth area, the left supraclavicular space, was exposed, using 135 kilovolts, a distance of 40 cm., 5 milliamperes, and filtration through 5 mm. of aluminum. The time of treatment was thirty-five minutes. There was an enlarged lymph node in this region. The patient returned the following April, markedly improved in general health and free from vaginal discharge. Examination did not reveal any definite activity in the field of the primary tumor.

At this time, the usual second course of roentgen-ray treatment previously described, including the treatment of the fifth field, the left supraclavicular space, was given. No apparent change in the size of the lymph nodes was observed.

This was a typical case of extensive carcinoma of the cervix uteri, and the response was satisfactory. It is seldom necessary to bury needles containing radium in the region of infiltration. As a rule, the field of treatment is infected, and thus additional

risk is assumed. When the cervical canal is eccentric, it may be necessary to place the needles to obtain a uniform response. They are also used effectively in the treatment of the metastatic infiltration in the walls of the vagina that is found in some cases. Metastasis to the left supraclavicular lymph nodes has been observed in an occasional case and this complication may prove troublesome.

Finally, the cases reported here were not selected on account of what may be considered an unusually good response to treatment; instead, they must be considered as cases which have responded satisfactorily to treatment and as representing the average result obtained by the intensive method of treating cases of carcinoma of the cervix uteri with broken doses of radium and roentgen rays.

UNUSUAL TUMORS OF THE SPINAL CORD

WINCHELL MCK. CRAIG

Case I.—A man aged fifty-nine years came to the clinic, January 17, 1929, because of pain in the lumbar portion of the spinal column and of weakness and numbness of the left leg. In October, 1928, five months before admission, the patient first noted an area of excessive cold perspiration above the left knee. This sweating occurred at intervals of a few days, lasting two or three days, for about a month. The area was 10 cm. in diameter just above the knee anteriorly and would cause a wet spot to appear on his trouser leg. One month after the onset of this perspiration, the patient was conscious of tingling and increasing numbness in the left leg, first from the knee down to the ankle and later extending into the thigh. Some infected teeth were removed in November, 1928, in the hope of improvement, but the condition steadily grew worse. About two and a half months after the onset, lancinating, severe pain appeared in the lumbar region at night, and the patient was obliged to get up and sit in a chair. This pain extended from the back in the lumbar region to both inguinal regions, including the iliac crests. The pain was also brought on and increased by jarring or moving. Deep inspiration would cause an increase in pain; coughing and sneezing also gave an exacerbation of pain. Four months after the onset of symptoms, ataxia of the left leg developed, which was followed by definite weakness in the leg. About the same time, numbness at the bottom of the right foot developed. During the month previous to admission, the bowels, which were ordinarily regular, became very sluggish, necessitating a regular cathartic.

The patient was of medium size and well developed. The systolic blood pressure was 158, and the diastolic pressure 90, measured in millimeters of mercury. The pulse rate was 72, and the temperature was normal. An abdominal scar from cholecystectomy, which had been performed in 1927, was noted. Both feet showed marked clubbing with hammer toes; this condition was congenital. Urinalysis was negative. The hemoglobin was 73 per cent; the erythrocytes numbered 4,640,000, and the leukocytes 4,600. The Wassermann reaction of the blood was negative. Vision in both eyes was 6/7. Pupils, fields, and fundi were normal. A roentgenogram of the thorax was negative, but a roentgenogram of the lower lumbar and sacral regions showed marked hypertrophic arthritis of the lumbar portion of the spinal column. Neurologic examination showed reduction in speed, tonus, and strength of all of the muscles of both lower extremities. The patellar and achilles tendon reflexes were slightly hyperactive on the left. There was a slight ankle clonus on the left and an increase in the internal and external hamstring re-

flexes; also, the cremasteric reflex was absent on the left. There was marked spasticity of the left leg and slight ataxia. An indefinite sensory level could be ascertained at about the first lumbar segment below which there was loss of pain and temperature (graded 2 to 3). There was also a loss of joint sense in both great toes. Spinal puncture was done and the cerebrospinal fluid was negative to the Kolmer test; total protein of 50 mg. for each 100 c.c., negative globulin test, 3 small lymphocytes, normal color, pressure of 17/6 and delayed response to jugular pressure were present. A diagnosis was made of tumor of the spinal cord, and exploration at the first lumbar segment was advised.

Operation was performed, January 26, 1929, at which time the spines and laminae from the tenth, eleventh, and twelfth thoracic vertebrae were

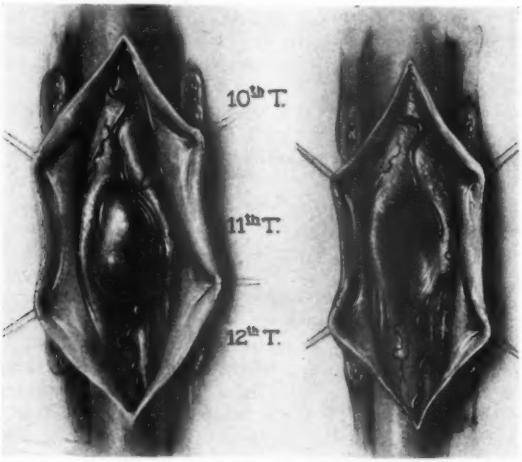

FIG. 74.—Neurofibroma, embedded in the spinal cord is completely removed.

removed. There was no pulsation of the dura and the tumor could be palpated opposite the eleventh vertebra. The dura was opened and a tumor was found lying imbedded in the cord and involving the posterior columns; the growth had the appearance of a knot on a tree, in that the upper portion was contiguous with the cortex of the cord, whereas the lower end was elevated and could be separated from the cord. The tumor was evidently attached to one of the nerve roots but was so firmly imbedded in the cord that its origin could not be determined. A suture was inserted in the lower pole and the tumor was elevated. After the capsule had been incised, a specimen was sent to the laboratory for microscopic examination of a frozen section of fresh tissue. The pathologist reported the tissue to be neurofibromatous in appearance. The tumor was then gently dissected free from the cord. After removal, there remained a marked depression in the cord which ex-

tended almost to the central canal but the cord did not seem to be injured (Fig. 74). Hemorrhage was controlled by pledgets of muscle.

Convalescence was uninterrupted and the operative wound healed by primary intention. When the patient was examined eighteen days after the operation he seemed to be much improved and was very happy over the result of the operation. He had not had any pain and the anesthesia and paresthesia had disappeared. He had regained strength, and the incoördination was markedly improved. The sphincters had regained normal tonus. At the time of dismissal, the patient's condition was still more improved, and subsequent letters report continued recovery.

Lesions of the spinal cord are so protean in their manifestation and the underlying pathologic changes are so varied that every case demands individual attention. The foregoing case did not present clear-cut diagnostic signs and yet certain symptoms designated the presence of a tumor of the spinal cord. The history of pain becoming worse at night and the partial subarachnoid block, together with the neurologic manifestations, substantiated such a preoperative diagnosis.

Tumors growing from and involving the spinal cord always carry a much more discouraging prognosis because they usually prove to be of the glioma group microscopically and either cannot be removed or tend to recur, whereas neurofibromas are enucleable and do not recur.

The subsequent convalescence and recovery of this patient substantiated the operative diagnosis of the lesion and further demonstrated the necessity of good pathologic facilities in dealing with unusual and difficult lesions at the operating table.

Case II.—A woman aged fifty years came to the clinic, April 1, 1929, complaining of difficulty in walking, and numbness in the legs and about the abdomen. About six months before registration, the patient noticed that she was stumbling at times when walking, due to clumsiness in the right leg. The right toe seemed to drag and to catch on the rugs and other obstacles. Shortly after this, she noticed numbness in the soles of both feet, most marked in the right. She had a sensation as if she were walking on pads and gradually the numbness increased and ascended until it involved the entire right leg. Immediately after this, the left foot and leg began to be numb, and this anesthesia extended up over the abdomen to the costosternal juncture. Later, she noticed a girdle sensation about the abdomen as though a tight rubber band had been stretched completely around her. Since the onset of trouble in November, the left leg had gradually become weaker and more difficult to handle until, at the time of examination, it was practically use-

less. Also, edema had developed and varicosity of the veins of both lower extremities. At first, she walked with a cane fairly well, but during the week preceding registration, she had had difficulty in walking even with assistance. She was unable to feel the position of her leg in bed and she had noticed, a few days before coming to the clinic, that she was unaware of the weight when she held her young daughter on her knee. For the previous two or three years, she had complained of a weak back at times and of a dull aching pain between the shoulder blades.

The patient was of medium height and weighed 174 pounds. The blood pressure was 92 systolic and 65 diastolic, with a pulse rate of 72 and normal temperature. Urinalysis was negative. The hemoglobin was 68 per cent; the erythrocytes numbered 4,000,000, and the leukocytes 5,200. The Wassermann reaction of the blood was negative. The blood grouping was II. A roentgenogram of the thorax was negative, but one of the thoracic vertebrae showed slight hypertrophic arthritis. There was slight kyphos in the middorsal region, which was postural and of no significance. Neurologic examination revealed weakness of the muscles in both lower extremities, more marked on the right. The patellar reflex was slightly increased on the left and the Achilles reflex was decreased, graded 2 to 3, on the right. The internal and external hamstring reflexes were increased, graded 1 to 2, on the left. The epigastric, abdominal, and hypogastric reflexes were abolished on both sides, as were also the anal reflexes. Positive Babinski and Chaddock signs were present on the right side. There was loss of joint sense in both great toes with diminution of vibration (graded 3) in both knees. Acuity of touch, temperature, and pain below the level of the third dorsal segment was lessened but not abolished. Examination of the cerebrospinal fluid revealed a negative Kolmer reaction, and 60 mg. total protein with a positive globulin reaction. There was 1 small lymphocyte and 1 large lymphocyte in each cubic millimeter. The color was normal and on bilateral compression of the jugular veins, there was no elevation of the fluid in the manometer, or a positive Queckenstedt's sign. A diagnosis was made of tumor of the spinal cord, and exploration was advised opposite the third thoracic segment.

April 8, 1929, laminectomy, consisting of the removal of the spines and laminae from the first, second, and third thoracic vertebrae, was performed. There was no pulsation of the dura when it was exposed and a mass could be palpated opposite the second thoracic vertebra within the dura. On incising the dura, a tumor could be seen lying on the right anterolateral aspect of the cord compressing it to about half its normal size. Although the lesion had the gross characteristics of an arachnoid fibroblastoma or dural endothelioma, it was not so discrete as those usually encountered. The upper pole was carefully elevated and the tumor was found to possess an exceedingly diffuse base. When the tumor was manipulated, the capsule was broken and a small specimen of tissue was sent to the laboratory for a frozen section and microscopic examination. The pathologist reported the tissue to consist of well differentiated arachnoid fibroblastoma. Consequently, the tumor was carefully outlined and was completely removed by resection of the dural attachment (Fig. 75). After the tumor had been removed, there could be demonstrated the large base which involved almost half of the dura and which

grossly resembled the endothelioma en placque within the cranial cavity which Cushing has described.

Convalescence was uneventful and the wound healed by primary intention. When the patient was examined, April 30, twenty-two days after operation, there was marked improvement in sensation and slowly returning power in both lower extremities. A letter from her in November, eight months after the operation, stated that she was walking and doing her own

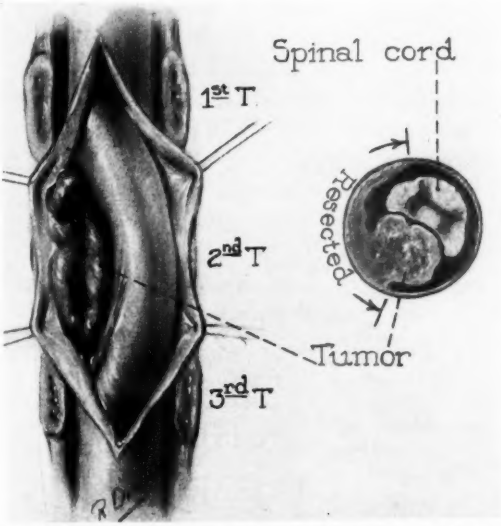

FIG. 75.—Arachnoid fibroblastoma with exceptionally large dural attachment.

housework, and that the edema and varicosities of both legs, which had been present previous to operation, had completely disappeared.

COMMENT

Both of these cases are of interest because the majority of all the tumors of the spinal cord which are operated on and found to be removable are classified as either arachnoid fibroblastoma or neurofibroma. These two cases demonstrate the necessity of a knowledge of the lesion at the time of operation. In the first case, the tumor had the appearance of a gliomatous lesion situated in the spinal cord itself, but by dissection of the caudal portion and removal of a specimen for

microscopic diagnosis, the type of lesion was determined and the entire tumor was removed. Also, in the second case, during operation, a discrete tumor was exposed, but although the tumor could have been removed without its base, it was of paramount importance to know the microscopic appearance of the tumor and to remove the entire base, regardless of the area of the dura involved, because if a portion of the base had been allowed to remain, recurrence would have been possible.

These two cases are presented not only because of the somewhat vague symptoms that were manifested, but because of the unusual character of the lesion. In the majority of cases, the gross appearance of tumor of the spinal cord is sufficient for a differential diagnosis but whenever the gross appearance is misleading, then the microscopic examination of fresh tissue proves of invaluable assistance. The ultimate result in both of the cases depended on the surgical removal of all tumor tissue. Knowledge of the type of growth led to greater precision in operating and more concise comprehension in prognosis.

PERFORATION OF THE DUODENUM; CHRONIC INTERSTITIAL CYSTITIS AND CHRONIC GRANULAR URETHRITIS; SUBACUTE APPENDICITIS AND HYPERTHYROIDISM

CLAUDE F. DIXON

PERFORATION OF THE DUODENUM

Case I.—A man aged fifty-two years came to the clinic October 30, 1929, complaining of paroxysmal attacks of sharp pain and burning in the epigastrium. During the last two weeks there had been relief from food, particularly milk. There was also occasionally some relief from sodium bicarbonate. Since the onset of symptoms the patient had vomited a few times, each time preceded by a sensation of fulness in the epigastrium. The vomitus did not contain blood. There was no history of tarry stools.

The patient was rather anemic and undernourished in appearance. His weight was 10 pounds below normal. Urinalysis was negative. The hemoglobin was 83 per cent, the erythrocytes numbered 4,400,000 and the leukocytes 5,600. The test meal showed a total acidity of 80, and free hydrochloric acid of 68. There was slight gastric retention. Roentgenograms of the stomach showed an obstructive lesion of the duodenum. A study of the blood showed: urea 22 mg., chlorides 561 mg. for each 100 c.c., and the carbon dioxide combining power of the plasma, 64 volumes per cent. During the night following the second day of examination, the patient was seized with a severe, sharp agonizing pain in the epigastrium. An opiate was necessary for relief. There was marked tenderness and slight rigidity in the upper right abdominal quadrant. The remainder of the abdomen was neither tender nor rigid. A diagnosis of perforating duodenal ulcer was made and the patient was hospitalized. For three days he was kept quiet in bed with packs of ice over the painful area. Only small amounts of water were given by mouth. A solution consisting of sodium chloride 1 per cent and glucose 10 per cent was given intravenously in 1000 c.c. quantities twice daily. On the fourth day after the patient's admission to the hospital, exploration was carried out, through an upper right rectus incision. The peritoneum was inflamed. The duodenum was partially plastered to the under surface of the liver. There was a small amount of thin yellowish bile-stained fluid free in the abdominal cavity. Careful exploration of the duodenum showed a perforation about 2 cm. in diameter about 3 cm. below the pyloric sphincter. Because of the friability of the duodenal tissue a satisfactory closure could not be made. Three or four interrupted sutures of silk were used in attempting the closure. Over this area the gastrocolic and the gastrohepatic omentum

were sutured. The stomach was markedly dilated. It did not seem wise to perform gastro-enterostomy because of the poor condition of the patient, and because of the obstruction of the duodenum; therefore, jejunostomy of the Witzel type was performed, with the use of a number 18 French catheter. The tube was brought through the omentum, and thence out of the abdomen through a stab wound. The primary wound was closed without drainage. Feedings through the jejunostomy tube were begun immediately. Nothing was allowed by mouth for ten days, when small amounts of liquids were given. Occasional gastric aspirations with a small duodenal tube revealed from 600 to 1,000 c.c. retention each twenty-four hours for sixteen days, after which time liquids were taken without distress or retention. The jejunostomy tube was kept in for twenty-seven days. By this time liquid and soft foods were easily taken orally and the tube was removed from the jejunum. The small wound healed in four days. The patient was dismissed from the hospital on the thirty-seventh postoperative day, at which time he was able to take light foods without discomfort. His general condition was good.

In this case apparently there were no symptoms until perforation occurred. Occasionally one sees an acute perforated duodenal ulcer without any previous history suggestive of such a lesion. Just how long complete perforation had been present in this case is questionable. The history is at least presumptive evidence that it had been present several days and possibly longer. The jejunostomy opening furnished a means of feeding and it was made much more rapidly than gastro-enterostomy could have been performed. Moreover, the stomach was put at absolute rest. Should further trouble arise, gastro-enterostomy could be performed and in all probability the condition of the patient would be much better than it was at the time of the first operation.

CHRONIC INTERSTITIAL CYSTITIS AND CHRONIC GRANULAR URETHRITIS

Case II.—A woman aged forty-three years came to the clinic September 21, 1929, complaining of dysuria, frequency and nocturia of fifteen years' duration. There was no history of hematuria. Occasionally intervals of two or three months had elapsed when the patient was comparatively free of symptoms except frequency. The dysuria would be slightly relieved at times by taking large amounts of sodium bicarbonate. A diagnosis of Hunner's ulcer had been made elsewhere. Fulguration had given slight relief until during the last eight months, when opiates had been resorted to. The pa-

tient's general physical condition was good except for marked nervousness and a loss of 15 pounds in weight.

Examination was essentially negative except for the urinalysis which showed pus cells graded 2. Roentgenograms of the kidneys, ureters, and bladder were negative. The tests of renal function gave a normal response. Cystoscopic examination showed a small bladder of 100 c.c. capacity, chronic interstitial cystitis, graded 3, involving most of the wall of the bladder, and chronic granular urethritis. The irritability of the bladder was extreme. Specimens of urine from both kidneys gave a negative result on culture and guinea-pig inoculation. Because of the long duration and severity of symptoms and because the condition was not amenable to treatment, the ureters were transplanted into the sigmoid. The operation was done in two stages. At the first stage the right ureter was isolated and cut off close to the bladder, and transplanted into the sigmoid. Ten days later the left ureter was likewise transplanted. The convalescence was without incident.

Three months have elapsed since the second operation. The patient has remained entirely free of symptoms, has gained 20 pounds in weight, and has resumed her usual household duties.

Ureteral transplantation into the sigmoid has heretofore been done mainly in cases of exstrophy of the bladder, occasionally for carcinoma of the bladder, and rarely because of vesicovaginal fistula. The technic of this procedure has been perfected so that the operation can be done with comparatively low risk. It would seem that, in some far advanced cases of Hunner's ulcer, such as the one presented here, ureteral transplantation into the sigmoid may be one way of affording the patient a comfortable existence.

SUBACUTE APPENDICITIS AND HYPERTHYROIDISM

Case III.—A woman aged twenty-three years came to the clinic May 13, 1929, complaining of attacks of sharp pain in the right lower quadrant of the abdomen of six months' duration. During the last two or three weeks the pain had been constant with acute exacerbations. There had been no nausea or vomiting.

Examination disclosed slight rigidity and tenderness in the right lower quadrant of the abdomen. The leukocytes numbered 9,600. Urinalysis was negative. Roentgenograms of the thorax were negative. It was the consensus of opinion that the patient exaggerated her symptoms somewhat. Because of this and the inability to rule out acute pelvic infection, she was hospitalized. Two days later she again experienced the severe pain. There was no radiation. The leukocytes numbered 17,200. There was marked tenderness and definite rigidity over the region of the appendix. Examination of the pelvis was negative. There was no vaginal discharge. Operation was advised.

Through a small low right rectus incision a subacutely inflamed appendix was removed. Exploration for Meckel's diverticulum was negative. The pelvic organs were normal.

The immediate postoperative convalescence was without incident. On the third day, the temperature, which had not been higher than 99 to 100° F., rose to 104.2° F. The pulse, which had been around 80, became elevated to 160 a minute. Peritonitis and postoperative hemorrhage were considered. Except for the elevation of temperature and rapid pulse there were no signs pointing to either of these diagnoses. There was no nausea or vomiting. Examination showed marked tremor which led to the consideration of hyperthyroidism. The thyroid gland was only slightly palpable, as had been noted on preliminary examination. Because of the tremor and unexplained elevation of pulse and temperature, a provisional diagnosis of exophthalmic goiter was made and large doses of compound solution of iodine were given frequently. Within twenty-four hours the pulse had dropped to 100 a minute and the temperature to 99.6° F. Iodine was continued for several days. On the eighth postoperative day the basal metabolism was +24 per cent. Two days later partial thyroidectomy was performed. A local anesthetic was used. The thyroid gland was enlarged to about twice the size of the normal gland. Tissue, amounting to about a fourth of a normal-sized thyroid lobe, was preserved on either side. The gross appearance of the gland was that of exophthalmic goiter. Microscopic examination showed diffuse parenchymatous hypertrophy with regenerative hyperplasia. Convalescence was without incident.

It seems logical to assume that this case would have eventuated into exophthalmic goiter crisis had iodine not been given. This case demonstrates that mild hyperthyroidism or potential hypothyroidism may be precipitated by some such shock as a surgical operation. It is possible that the acute infection in the appendix may have been a factor also in precipitating a definite hyperthyroid reaction in this case.

Hyperthyroidism is not always easily diagnosed. In surgical cases when postoperative complications arise one usually attempts to account for the symptoms on the basis of a direct complication from the surgical procedure. This case would suggest that hyperthyroidism may go undiagnosed in such instances unless its possibility is kept constantly in mind.

COMPLICATIONS OF DERMOID CYSTS OF THE OVARY; CHEMICAL HYSTERECTOMY

VIRGIL S. COUNSELLER

DERMOID cysts of the ovary contain some or all of the elements of the skin, as well as bones, nerves, and mucous membrane. They are usually unilocular and exhibit, more or less perfectly, layers of skin, sebaceous glands, sweat glands, and hair. It is not uncommon to find teeth imbedded in the wall of the cyst.

According to Kelly the walls are lined by many layers of squamous-cell epithelium, varying from a thin membrane, almost transparent, to one that is thick and leathery; the contents are oily, thick, greasy, and sometimes cheesy, due to the secretions of the sebaceous glands and fatty degeneration of the epithelial cells.

Complicating conditions are more common than in other types of ovarian cysts since attacks of localized peritonitis may occur. The two cases presented here illustrate two complicating conditions which occur with these cysts.

INFECTED DERMOID CYST WITH FISTULA OF THE VAGINA

Case I.—A woman aged forty-five years was admitted to the clinic, August 19, 1929, complaining of weakness, pain in the thighs, and a discharge from the vagina. She had been quite well, except for this discharge, previous to March of this year, when a severe pain developed in the right lower quadrant of the abdomen and down the thigh. This had been followed by considerable weakness and soreness in the region of the coccyx. Her appetite gradually failed and she lost 30 pounds. She had become weaker progressively and since ten days prior to registration she had been unable to walk without assistance. Ten years before admission a pelvic abscess developed immediately postpartum which was drained through the vagina. This had continued to discharge foul material intermittently but chills had not occurred, nor had the temperature increased.

The systolic blood pressure was 112 and the diastolic 78. The temperature and pulse were normal. The Wassermann reaction of the blood was

negative. Analyses of the urine and gastric content were negative. The examination of the blood was negative. On examination of the pelvis a tender mass about 10 cm. in diameter could be felt to the right of the uterus. The uterus was of normal size, but slightly fixed in the median position. A fistulous tract opened to the right of the cervix from which foul purulent material was discharged. On account of extreme tenderness in the region of the pelvic mass hot douches were administered twice a day for two weeks. Following this treatment the mass decreased considerably in size and was not so tender, and exploration of the fistulous tract was advised.

Under gas anesthesia the fistulous tract was dilated and explored with placental forceps. Large amounts of foul-smelling hair and necrotic substance were removed. The cavity was completely evacuated and cureted with a uterine curet, then irrigated with water, wiped out with iodine gauze and packed with one strip of iodoform gauze.

The convalescence was uneventful. The gauze was gradually removed daily so that it was all out by the fifteenth postoperative day. Examination four days later showed that the mass was almost obliterated, and the foul discharge had ceased. Hot douches daily for three weeks were advised, following the patient's dismissal from the hospital.

DERMOID CYST WITH TWISTED PEDICLE

Case II.—A woman aged fifty-eight years was admitted to the clinic August 5, 1929, complaining of severe pelvic pain and weakness. For twenty years she had had attacks of severe pain in both sides of the pelvis, lasting only a few minutes. These were usually followed by slight leukorrhea. Six months prior to registration several attacks of pain in the left side of the pelvis occurred in rapid succession associated with swelling in the same area; these attacks lasted six days. There was no fever or chills. During the last two months the attacks had occurred frequently and nine days before admission one attack was so intense that she was admitted to the local hospital for treatment. This attack was associated with nausea and vomiting. She lost 40 pounds and became progressively weaker.

On examination the patient was thin and appeared dehydrated. The temperature, pulse, and respiration were normal. Pelvic examination was extremely painful on account of a large tender mass about the size of a four months' fetus which occupied the position of the uterus. The latter could not be determined separately. The adnexa on both sides were tender but free from palpable masses.

A diagnosis of pyometritis or inflammatory disease of the pelvis was made and hospitalization and conservative treatment advised. Slow hot douches were given twice a day and ice packs were placed over the lower part of the abdomen. Large quantities of fluids were given by mouth daily to correct the dehydration. After two weeks evidence of pelvic inflammation had largely subsided but the mass remained the same size. Pelvic exploration was advised.

At operation an ovarian cyst about 10 cm. in diameter was found. It was necrotic and covered with omentum. The sigmoid was attached firmly

to it over the left side and posteriorly by fibrinous and fibrous adhesions, but the cyst had not perforated into the bowel. The cyst was twisted two and a half times on its pedicle almost excluding the blood supply to the left tube and ovary. It was separated from the sigmoid, bladder, uterus, and omentum, and left salpingo-oöphorectomy was performed. The uterus was atrophic and was situated behind the cyst. The raw anterior surface of the uterus which was exposed where the cyst was removed was protected by suturing the round ligaments over it. The right tube and ovary were normal. The appendix was atrophic and was not removed.

The pathologist reported the mass to be a hemorrhagic dermoid cyst containing sebaceous material and hair. The patient convalesced uneventfully and was dismissed from the hospital on the fourteenth postoperative day. In a recent communication she stated that four months after the operation she is in good health.

COMMENT

Dermoid cysts of the ovary constitute 4 to 5 per cent of all ovarian tumors. Marshall recently reported a series of 415 cases in which operation was performed at The Mayo Clinic (to November 1, 1927). The diagnosis was not made in any case before operation. Pelvic tumor was diagnosed in 37 per cent; ovarian cyst in 26 per cent; uterine fibromyoma in 15 per cent; abdominal tumor in 5 per cent; acute appendicitis in 4 per cent; pelvic inflammatory disease in 2.5 per cent, and extra-uterine pregnancy in 4.1 per cent. In three cases of the series draining fistulas, two abdominal and one vaginal, occurred following operation elsewhere.

In Case I the vaginal fistula originated in an infected ovarian dermoid cyst. Such cysts may occur at any period in life, but they are the most common form of ovarian tumor seen before puberty. At puberty and immediately afterward, unilocular cysts, chiefly parovarian, are more common than dermoid cysts. Most of the reported cases occurred between the ages of twenty and forty years; a few have been found beyond this period.

The diagnosis of dermoid cyst of the ovary is rarely made before exploration since symptoms may not be present for years. This is explained by the fact that they are slow growing as compared to proliferating cysts of the ovary. There is a marked tendency for these tumors to become fixed in the pelvis by attachment to the rectum or vagina when they become secondarily infected. Pregnancy and parturition have been reported as the

most common causes of the symptoms originating in dermoid cysts either by producing torsion of the pedicle as the cyst is pushed upward by the pregnant uterus or by trauma to the tumor which is adherent in the pelvis during delivery. A diagnosis of inflammatory disease of the pelvis or abscess is frequently made, as in Case II. When suppuration occurs, perforation into the rectum, vagina, or bladder usually takes place, as in Case I. The most common site of rupture is the vagina; the next in frequency is the rectum. The resultant fistula remains for months or years unless the content of the cyst is completely evacuated.

The treatment of complications of dermoid cysts of the ovary is purely surgical. When suppuration and perforation have occurred, it is far safer to dilate the fistulous tract, evacuate the cyst as thoroughly as possible, and scrape the inner wall with a sharp curet so as to eradicate the epithelial lining and all dermoid structures. Free drainage must be established by thorough dilatation of the fistulous tract. If the wall of the cyst has not been punctured by the curet, the cavity should be irrigated thoroughly with a warm solution of sodium chloride and packed solidly with iodoform gauze. The gauze is gradually removed and the cyst and fistulous tract will contract down to a scar, provided all elements of the cyst have been thoroughly removed. It is extremely difficult and dangerous to remove a dermoid cyst by the abdominal route which has perforated externally, on account of the high risk of general peritonitis, the deep situation of the tumor in the pelvis, and the dense adhesions of the wall of the cyst to adjacent structures. Abdominal exploration must be performed as soon as a diagnosis has been made of cyst of the ovary with a twisted pedicle, for the blood supply, as a rule, is practically shut off and if the cyst is a dermoid, it may perforate into the peritoneal cavity and produce fatal peritonitis. However, the pedicle may become twisted and the cyst remain in the pelvis where it is covered and protected by the omentum. This condition is usually diagnosed and treated as pelvic inflammatory disease or pelvic abscess. The true condition is revealed when the cyst perforates externally or is drained surgically through the culdesac.

CHEMICAL HYSTERECTOMY

CHEMICAL hysterectomy appears to be gaining in popularity as a surgical procedure in certain selected cases. The caustic agent, zinc chloride, which is used in these cases was introduced fifty years ago in the treatment of carcinoma of the cervix and uterus, but only in recent years has its use been extended to selected benign conditions of these organs. Babcock advised that it be used to destroy an infected endometrium, such as occurs in chronic gonorrhea and other infections of the uterus that resist milder therapeutic measures, to produce absolute sterility in mental defectives, and to eradicate recurring uterine polyps and submucous fibromyomas lying close to the endometrium.

Masson and Foucar, in 1925, reported the use of zinc chloride in thirty cases of benign lesions of the cervix and uterus at The Mayo Clinic with very favorable results. The chief complaints in twenty-six of their cases were bleeding, menorrhagia, metrorrhagia or irregular bleeding after the menopause; in the other four cases the complaint was chiefly of leukorrhea. In none of the cases did the condition seem to warrant radical surgical procedures.

The case reported here is representative of a group of cases in which chemical hysterectomy is not only advisable, but perhaps is the best form of surgical treatment.

REPORT OF CASE

A woman aged forty-two years registered at the clinic, October 7, 1929, complaining of painful deformed joints and excessive bleeding during the menstrual periods. Nine years prior to registration she had had painful swelling of first one joint and then another; this progressed insidiously until nearly all the joints were involved. The condition had varied greatly; at times she was able to do her own housework and at others she was unable to dress herself. The tonsils had been removed and the teeth extracted, to eradicate foci of infection. Baking and massage had been employed without noticeable relief. Three years before admission the flow at the menstrual periods became excessive and was prolonged from four to seven days. There

was also a leukorrheal discharge which had not existed prior to the menstrual disturbance. She had been pregnant three times, and had had one miscarriage and two living children.

On examination the patient appeared to be well nourished but anemic. There was a systolic murmur and thrill at the apex of the heart. The metacarpophalangeal joints of both hands were thickened and the phalanges were deflected laterally. The motion of the joints in both elbows, wrists, and ankles was restricted. The cervix was soft, patulous, and lacerated, and emitted a mucopurulent discharge. The fundus of the uterus was slightly enlarged and the adnexa were normal. Since the cervix should be considered a possible focus of infection from a local standpoint, cultures were taken from it. These inoculated in brain broth showed a streptococcal infection to be present.

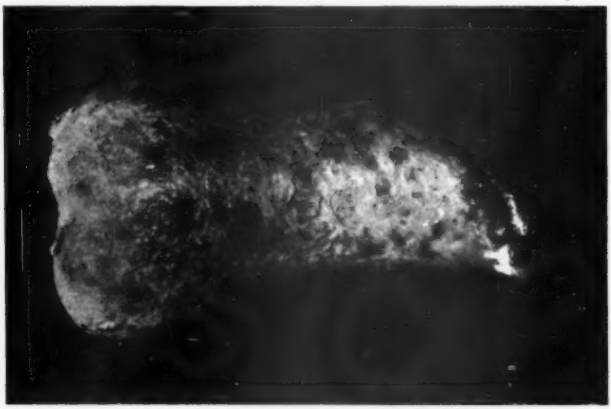

FIG. 76.—Cast removed fifteen days after operation.

Because of the menorrhagia and associated infective cervicitis in a normal-sized uterus, and because of the mitral stenosis and chronic progressive rheumatoid arthritis, chemical hysterectomy was advised. It was performed, October 15, under general anesthesia. The cervix was dilated and the uterus was thoroughly cureted and sponged dry with one strip of iodoform gauze. The cervix was grasped by one tenaculum forcep on the anterior lip and one on the posterior lip. The entire vagina was then covered with a thin layer of petrolatum and over this and around the cervix was placed plain gauze soaked in a solution of sodium bicarbonate as a protection against contact of the vaginal mucosa with the caustic zinc chloride. A strip of plain gauze, about 2 cm. wide, with selvedge on either edge, was dipped in a saturated solution of zinc chloride and squeezed fairly dry. The gauze was then carefully packed into the uterus and the cervix; only a small strip of it was left just inside of the external os. The cervix was held shut by two towel clips to prevent any of the solution from dropping onto the mucous membrane of

the vagina. The gauze was removed from the uterus in thirty-five hours under continuous irrigations with a solution of sodium bicarbonate. Douches with the solution were given twice daily until the cast had separated and was removed, which occurred on the fifteenth postoperative day without incident (Fig. 76).

COMMENT

It has been definitely proved that the cervix is the focus of infection in many cases of rheumatism and secondary infections of the eye. Frequently a cervix which is the seat of chronic streptococcal infection is associated with polypoid endometritis and troublesome leukorrhea. This condition is most common among patients aged more than forty years; the patients occasionally are obese and have chronic disease of the heart or kidneys.

High amputation of the cervix or coning out of the gland-bearing portion of the cervix may be sufficient to eradicate the infection, but does not cure the menorrhagia. Total abdominal hysterectomy may be contraindicated because of complicating conditions which may arise subsequently.

Chemical hysterectomy by the use of zinc chloride, as used in the clinic, has proved a safe procedure and one which accomplishes the same result as total abdominal hysterectomy. It should not be substituted for total abdominal hysterectomy, but used only if destruction of the endometrium and cervix is desirable.

Convalescence following chemical hysterectomy is usually uneventful. The course is usually afebrile because the zinc chloride acts rapidly on the endometrium, forming a zinc albuminate in the cells. The smaller blood spaces and lymphatics are rapidly sealed by the corrosive action, thus preventing any absorption into the general circulation. After about ten days the cast separates and is discharged into the vagina, leaving only a thin layer of uterine muscle which soon contracts to about the size of an infantile uterus. It may be necessary to grasp the cast with forceps and rotate it in order completely to separate and extract it. However, it usually is discharged spontaneously. Postoperative bleeding rarely occurs, but if it does occur a light vaginal pack is sufficient to control it.

A STUDY OF THE VESSELS OF THE EXTREMITIES BY THE INJECTION OF MERCURY*

BAYARD T. HORTON

THE surgical treatment in advanced cases of thrombo-angiitis obliterans and arteriosclerosis involving the lower extremities, when gangrene is present, has been amputation, either above or below the knee, and yet there is no accurate clinical method for selecting the site of amputation in a given case. It has been shown[1] that in selected cases of thrombo-angiitis obliterans in which amputation is eventually necessary, in approximately 80 per cent, healing will take place when the level of amputation is below the knee, whereas in cases of arteriosclerosis, especially if the patients are aged more than sixty years, it is almost invariably necessary to amputate above the knee. The older the patient, apparently the less adequate the collateral circulation to the extremity; for this reason, relatively high amputation is necessary in older persons, and frequently will take place below the knee in younger persons. The presence of a pulsating popliteal artery is not the essential factor in healing below this level, although without a careful study of cases it would seem that the presence of a palpable popliteal artery would be the deciding factor as to whether, in a given case, amputation should be above or below the knee. Burke,[2] in a recent survey of a group of cases of thrombo-angiitis obliterans at The Mayo Clinic, has shown that in twenty-four, in which amputation below the knee was successful, there were pulsations in the popliteal artery in only nine. In the other fifteen cases the popliteal artery was occluded, and yet healing was fairly prompt.

* Read before the Section on Orthopedic Surgery at the Eightieth Annual Session of the American Medical Association, Portland, Oregon, July 8 to 12, 1929.

The present study was undertaken in order to determine the extent of the occlusive process in amputated extremities, and later, quantitative studies of the filling of the arterial tree were carried out.

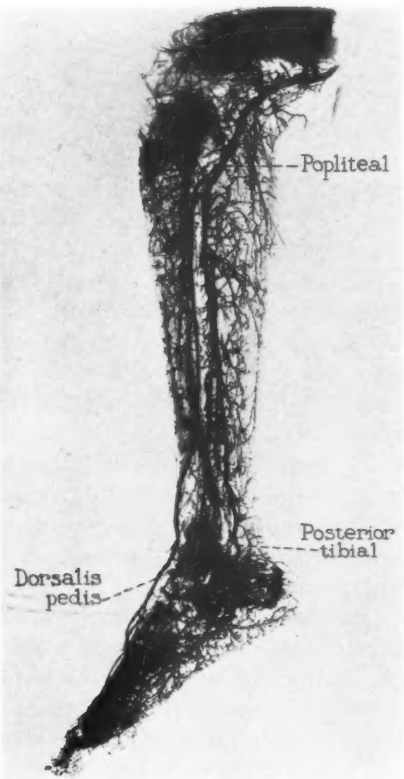

FIG. 77.—Normal arterial tree after injection with mercury under a pressure of 20 to 30 mm. The arterial tree is uniformly filled. The patient was a man aged fifty-five years.

Metallic mercury was used to inject into the arterial tree in forty-two recently amputated extremities (Fig. 77). Seventeen were in cases of thrombo-angiitis obliterans, and nineteen, in

cases of arteriosclerotic disease. The others represented a miscellaneous group, namely, osteomyelitis, sarcoma, epithelioma, clubfoot and ununited fracture. The injections were made under pressures ranging from 15 to 160 mm. of mercury, with the specimen in the horizontal position. Pressure of from 30 to 40 mm. was used in the average case. Immediately after completion of the injection, both flat and stereoscopic roentgenograms were made of the specimens. Later, the specimens were dissected, with the use of the roentgenograms as guides in the study of the arterial tree. An effort was made in each case to confirm the data shown in the roentgenograms by careful dissection of the arterial tree. Numerous sections of the veins and arteries at various levels were taken for microscopic study. All of the specimens were amputated just above or just below the knee joint with the exception of one arm, which was amputated through the middle third of the humerus.

In the group of patients with thrombo-angiitis obliterans the youngest was aged thirty-one years, and the oldest, seventy-three. The latter represents the oldest patient whose case is on record at The Mayo Clinic. The clinical diagnosis was made prior to amputation. One patient was a woman, aged sixty years, whose right leg was amputated above the knee. This is the first case of thrombo-angiitis obliterans in a woman that has been seen at The Mayo Clinic. In the group with arteriosclerosis the youngest patient was aged forty-eight years, and the oldest, seventy-eight years. In a small number of cases of both thrombo-angiitis obliterans and arteriosclerosis, the specimen was weighed before and after injection, so that accurate data were obtained regarding the capacity of the arterial tree. Unfortunately, data on normal extremities with which to compare these filling ratios are not available at the present time, and none was found recorded in the literature.

In cases of thrombo-angiitis obliterans, there were marked variations in the appearance of the various arterial trees, depending on the extent of the occlusive process in the vessels. In some specimens (Fig. 78) the arterial tree appeared almost normal and in others (Fig. 79) the original arterial tree had been

entirely occluded and replaced by a collateral circulation which, for a long period of time at least, had been sufficient to supply the extremity with an adequate amount of blood. In Figure 78 the arterial tree appears normal except for the closure of the dorsalis pedis artery in its middle third, and a slight filling defect on the lateral aspect of the great toe. Clinically, the

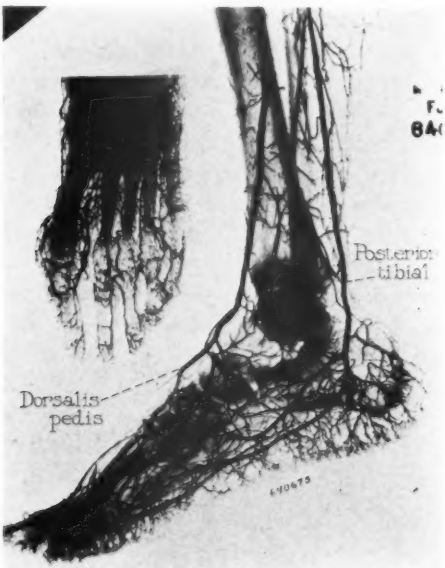

FIG. 78.—Arterial tree in a case of thrombo-angiitis obliterans in a man aged forty-three years. The clinical duration of the disease was ten months. The arterial tree is normal except for an occluded dorsalis pedis artery and absence of demonstrable vessels on the medial aspect of the great toe (gangrenous area).

popliteal artery was closed, and pulsations could not be felt below this level. There was moist gangrene along the distal lateral half of the great toe. The case represented in Figure 79, presented the same clinical features, so far as the circulation in the extremities is concerned, as did the case represented in Figure 78. There was beginning gangrene of the distal third of

the great toe in this case, also. Both legs felt cold. Pulsations below the femoral artery were absent. There was marked pallor when each extremity was elevated, and marked rubor when it was placed in the dependent position; yet the arterial trees were markedly different in the two cases. There is no clinical method, at present, for distinguishing between these two extremes. In the average specimen, the occlusive process was diffuse, but patchy in its distribution, and formation of collateral

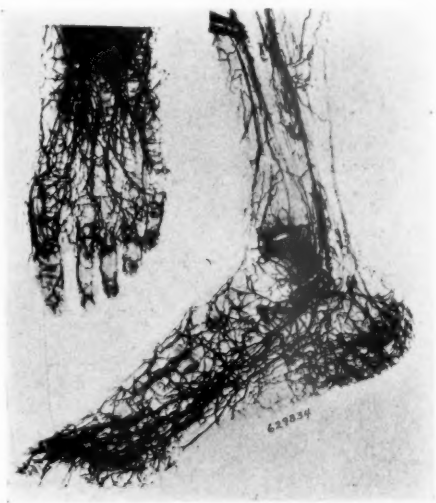

FIG. 79.—Arterial tree in a case of thrombo-angiitis obliterans in a man aged fifty-two years. The clinical duration of the disease was fifteen years. The arterial tree is not normal and formation of collateral vessels is marked.

vessels was marked. This was the most striking feature observed in cases of thrombo-angiitis obliterans. From the appearance of the roentgenograms, it would seem that thrombosis of a segment of a vessel occurs, collateral circulation develops above it and then another segment closes. The ratio between the rapidity and extent of the occlusive process, as compared with formation of collateral vessels, determines the ultimate preservation of the limb. If the segments affected are large and

the closure rapid, the prognosis is poor; if they are small and closure is slow, the prognosis is good.

A very unusual picture was observed in three amputated limbs, following lumbar sympathetic ganglionectomy. In one case (Fig. 80) in which bilateral lumbar sympathetic ganglion-

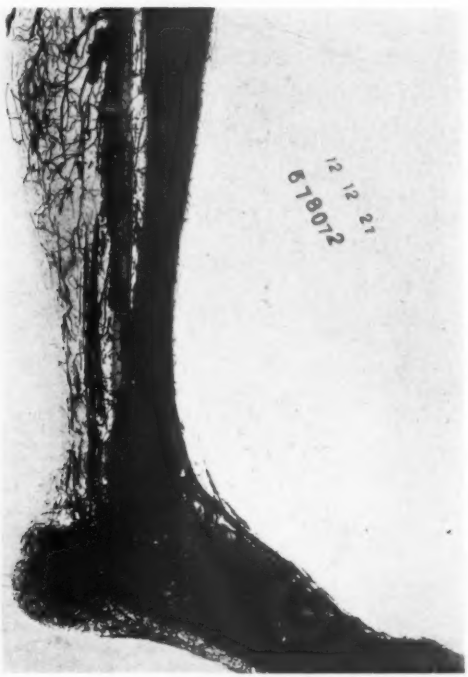

FIG. 80.—Vascular tree in a case of thrombo-angiitis obliterans. Mercury was injected one year after lumbar sympathetic ganglionectomy. Occluded vessels with attempts at formation of collaterals are shown. The patient was a man aged thirty-one years.

ectomy had been performed one year prior to the amputation of the left leg above the knee, a most interesting condition was observed. The injection material was introduced into the arterial tree under a pressure of 20 to 30 mm. of mercury and the mass, after filling the arterial tree, flowed through the capillary

bed and into the venous system. Two months later the right leg was amputated and exactly the same result was obtained with injection. It required 55 c.c. of the injection mass to fill the vascular tree in the left leg, and only 12 c.c. to fill the arterial

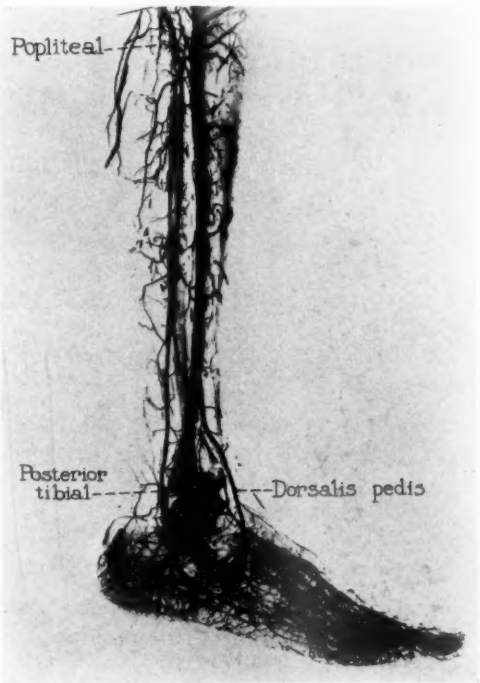

FIG. 81.—Arterial tree in a case of arteriosclerosis. Injection with mercury was made under pressure of 60 to 150 mm. Three weeks after a surgeon elsewhere had performed periarterial sympathectomy by stripping the adventitia from a segment of the popliteal artery. The patient was a man aged sixty-two years. The main vessels are open; collateral circulation is absent.

tree in a similar specimen (Fig. 81) obtained from a patient with arteriosclerosis. It is interesting in Figure 81, to note that the mercury did not pass through into the venous system to any extent even though, elsewhere, the patient had undergone peri-

arterial sympathectomy applied to popliteal artery, by the Leriche-Handley method, three weeks prior to amputation. In a second case the patient had had his right leg amputated at its middle third fifty-six days after bilateral lumbar sympathetic ganglionectomy had been performed. The specimen weighed

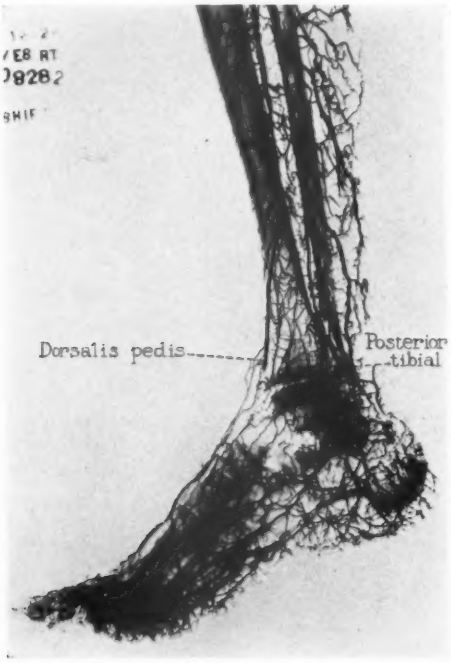

FIG. 82.—Arterial tree in a case of arteriosclerosis. Mercury was injected under a pressure of 50 mm. The patient was a man aged sixty-six years. Occlusion of the dorsalis pedis and posterior tibial arteries is evident. Filling ratio 4.8 per cent.

1,155 gm. The injection material was introduced under a pressure of 15 to 20 mm. of mercury. With this relatively low pressure the injection mass again passed through the capillary bed and into the venous system. When injection was made under 50 mm. pressure the vascular tree contained 345 gm.,

or approximately 25.3 c.c. of mercury. A similar specimen from a case of thrombo-angiitis obliterans (weight 1,940 gm.) in which the material was injected at the same time and under the same pressure and in which sympathetic ganglionectomy had not been performed, required only 132 gm. of mercury (9.7 c.c.) to cause the arterial tree to be filled. Still another specimen (Fig. 82) (weight 4,200 gm.) obtained from a case of arteriosclerosis, when mercury was injected under the same pressure of 50 mm., required only 216 gm. of mercury, or approximately 15.9 c.c., to fill the arterial tree. The filling ratio (weight of mercury injected divided by weight of leg after injection) in the specimen derived from a patient who had undergone sympathetic ganglionectomy was 23 per cent; that from the patient with thrombo-angiitis obliterans in whose case sympathetic ganglionectomy had not been done was 6.3 per cent, and that in the case of arteriosclerosis was 4.8 per cent. The filling ratio in cases of thrombo-angiitis obliterans ranged from 3 to 6.3 per cent. The venous filling ratio in a specimen from a case of thrombo-angiitis obliterans in which only the veins were filled, was 12.8 per cent.

In cases of arteriosclerosis, the results of observation were fairly constant. In most of the specimens the main arteries in the leg and foot were patent, but were reduced in caliber, whereas collateral circulation in many specimens was absent to a rather marked degree (Fig. 81). Frequently, however, occluded segments were observed in the main arteries, and in a few specimens collateral circulation was well developed. In one case of arteriosclerosis the popliteal artery was completely occluded by a recent thrombus, and the collateral circulation connecting the popliteal with the posterior tibial artery was well developed. This specimen was obtained from a man aged seventy-eight years. If this same occlusive process had occurred in a younger person it is possible that the collateral circulation would have developed to a point at which amputation would not have been necessary. The filling ratio in these cases ranged from 3.8 to 5.3 per cent. The filling ratios in cases of thrombo-angiitis obliterans and arteriosclerosis are essentially the same. This

would indicate that the circulation in the two groups of cases must be reduced to essentially the same level before amputation is eventually necessary. The filling ratio in diabetic gangrene was slightly less than in the average case of arteriosclerosis not associated with diabetes mellitus. The occlusive process was so marked in six of the seventeen cases of thrombo-angiitis obliterans that I was not able to perform injection of the arterial tree and in the arteriosclerotic group I was able to carry out injection in fourteen of the nineteen cases. In five of the cases the occlusive process was so marked that it was not possible to inject the material into the arterial tree, even using a pressure as high as 200 mm. of mercury.

Essentially the same data were observed in the roentgenograms with reference to the arterial tree in cases of diffuse osteomyelitis of the tibia and of arteriosclerosis. The main vessels in the leg and foot were open, but collateral circulation in the leg, and to a certain extent in the foot, was practically absent. This brings up an interesting question and emphasizes that diffuse osteomyelitis of the long bones of the leg not only affects the bones, but affects the blood vessels of the extremity to the extent that the collateral circulation of the leg may be partially or, in extreme cases, almost totally occluded.

Marked changes were not observed in the arterial tree in a leg which was amputated because of a severe radium burn. The ulcer occupied approximately the middle third of the anterior surface of the leg. The pathologist diagnosed the ulcer as malignant. Marked changes were not observed in a leg amputated because of sarcoma, except that the vessels were slightly constricted and distorted as they passed through the sarcoma, which involved the upper third of the leg.

In one specimen there was an ununited fracture in the lower third of the tibia, and injection of the arterial tree showed definite constriction of the anterior tibial artery opposite the site of the fracture, and marked diminution in the blood supply of the region of the fracture. Soft tissue was not present between the fragments, which were in good apposition. The decreased blood supply was so definite that it may have been a

factor in the nonunion of the bone, although one cannot draw accurate conclusions from a single case.

The amount of the injection mass required to fill the arterial tree in cases of thrombo-angiitis obliterans and arteriosclerosis varies a great deal from that reported by Lewis and Reichert.[3] It required approximately 12 to 15 c.c. to fill the arterial tree in the average case of thrombo-angiitis obliterans in which amputation was done below the knee. In the average case of arteriosclerosis in which amputation was done at or above the knee, approximately 18 to 20 c.c. was required to fill the arterial tree. The filling ratio in each case was essentially the same. Lewis and Reichert, using Hill's mass of bismuth oxychloride, injected under a pressure of about 200 mm. of mercury, found that it required from 100 to 120 c.c. to fill the arterial tree in a case of thrombo-angiitis obliterans, as compared with from 30 to 40 c.c. in cases of arteriosclerosis. This marked difference was not observed in any of the cases which I have studied. The capacity of the vascular tree was reduced to a minimal amount before amputation was eventually found necessary.

It should be emphasized that lumbar sympathetic ganglionectomy does not produce cure in cases of thrombo-angiitis obliterans. In the three cases which are reported, the occlusive process was progressive in spite of the increased flow of blood to the extremities following the operation, and amputation eventually was necessary. The increased flow of blood to the extremities following this surgical procedure places the patient in a better position to ward off gangrene, but unfortunately does not eradicate the disease. These injections give positive anatomic proof of the vasodilating effects of sympathetic ganglionectomy. They also confirm in general the clinical impression that the older the person, the less adequate the collateral circulation. After a person reaches the arteriosclerotic age and arterial occlusion develops, the ultimate amount of collateral circulation is usually inadequate and not comparable to that seen in younger persons with thrombo-angiitis obliterans. This affords a good reason for not attempting vasodilating operations, such as sympathetic ganglionectomy, for older patients suffering

from arteriosclerotic disease. It also explains the frequent failures in attempts to save stumps below the knee in cases of arteriosclerosis, and the greater percentage of success following the same effort in cases of thrombo-angiitis obliterans.

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POSTOPERATIVE TREATMENT OF ABDOMINAL ACTINOMYCOSIS[1]

FREDERICK L. SMITH

MANY treatments have been recommended by those interested in the study of actinomycosis. The satisfactory results obtained by New in the treatment of actinomycosis of the jaw and neck are well known; copper sulphate taken internally and given by irrigation are well recognized methods of treatment; the British have reported apparently favorable results with potassium iodide in huge doses, with sodium iodide given intravenously and with colloidal iodine, but none has been entirely successful, used alone, when the thorax or abdomen is involved. The unsuccessful results may be accounted for to some degree in that thoracic and abdominal types of the disease, especially, remain undiagnosed for long periods of time and marked involvement with physical debility has occurred. This paper will have to do with treatment of the abdominal type of actinomycosis.

The diagnosis once established one must decide on the extensiveness of the disease, whether metastatic involvement through the blood stream or lymphatics or by direct extension to the liver and thorax has taken place, how much local involvement there is, the chances of surgical operation eradicating the infection by excision and whether satisfactory drainage can be established.

When surgical methods are resorted to, unless the affected area can be totally excised, the wound should be left open as far as possible for the purpose of packing and topical treatment. If multiple sinuses persist, all should be opened sufficiently either to allow of them being packed or to permit plenty of

[1] Read before the Association of Resident and Ex-Resident Physicians of The Mayo Clinic and The Mayo Foundation, October 9, 1929.

drainage. The characteristic sealing in of the ray fungus in the traumatic tract effected by the throwing out of exudate, and by burrowing, must be constantly looked for, for as soon as the fungus is permitted to remain unexposed, grouping takes place and an abscess results. A wound may look clean, it may have been packed tightly every twenty-four hours, and yet a new abscess may be establishing itself in close proximity to the treated wound. Patients should be closely watched as to weight, temperature, and general health. If the patient says that he has noticed a slight pain for the last two days or so he should not be told that pain is to be expected on account of injury to nerves and muscles, but his temperature should be taken and a blood count should be made. Probably the observer will be surprised to find a slight or moderate rise in temperature and a slight loss of weight and appetite. At any rate, the wound should be investigated, and although the granulation may seem to be firm, it may be possible, with a curved forcep, to uncover a large abscess. This should be opened immediately, as widely as possible, and the wound should be thoroughly packed. Solution of copper sulphate 1 per cent, of potassium permanganate 0.003 per cent, and of iodine 1 to 2 per cent, all have been used in medication. The topical therapeutic agent should be one that does not cause coagulation of the tissues, for coagulation would help to seal in the pathologic process present. The ideal topical agent will dissolve the exudates, expose the tissue to the action of oxygen and, at the same time, will unite with the proteins of the tissues and deliver to the infected area a bactericidal agent. For this reason dichloramine-T, in a 4 per cent solution, is of value in open wounds or deep tracts. Another agent which has proved satisfactory is compound solution of iodine (Lugol's solution) diluted one-third to one-half with water. The edges of the wound in both instances necessarily have to be well protected with strips of gauze covered with petrolatum applied well over the edges of the wound, or severe dermatitis will follow. There is one detail which should be emphasized in the packing of a cavity and especially if it is deep and narrow. Gauze saturated with the drug should be

straightened out and the instrument carrying the gauze should be inserted to the bottom of the tract and kept there. The gauze should be fed in slowly. If the packing instrument is withdrawn, it pushes in several coils of gauze which will plug the tract exterior to the place where the gauze should be applied. Thereby a space is left intervening, with possibly only one strand of the gauze between; this permits granulation and exudate to fill the space and on removal of the pack the next day one observes an irregular, narrowed tract.

Our procedure is as follows: As soon as the patient arrives at the dressing service the wound is explored, and if it is not satisfactorily clean it is douched with hydrogen peroxide solution for fifteen or twenty minutes until it is certain that the tract is cleaned of exudate. Then the tract is gently swabbed out until it is dry, and if dichloramine-T is used it is applied as has been described. If compound solution of iodine is used, drying is not necessary. It is my custom, when sulphur bodies are repeatedly found in the sulci of the wound, to have radium introduced. Treatment by roentgen ray is applied to the whole region. Moreover, these patients are saturated with iodides; either solution of sodium iodide 10 per cent is given intravenously, beginning with 30 to 40 c.c. and increasing 10 c.c. each day up to 100 c.c. for each day, or saturated solution of potassium iodide is administered by mouth beginning with 40 drops three times a day and increasing to as much as 180 drops three times a day, depending on the tolerance of the patient. The intravenous method of administration has a greater tendency to destroy the appetite than the giving of potassium iodide by mouth. However, the latter method also is irritating to a slight degree. Administration of tincture of iodine, beginning with 8 minims and increasing to 15 minims in cream three times a day may be substituted for the potassium iodide. The finely divided colloidal suspension of iodine in cream is easily taken and has no disagreeable taste. Epstein and Schoenholz recently reported the results of treatment with foreign protein in the case of a patient whose neck was involved. This patient received four intravenous injections, given at intervals of three days, of killed

typhoid and paratyphoid organisms. These four injections contained, respectively, 75,000,000, 100,000,000, 125,000,000, and 150,000,000 organisms. Each treatment was followed by a chill and slight rise in temperature. The patient was in the hospital nine days. Three months later he was reported to be apparently well. General application of ultraviolet or solar rays is indicated to maintain bodily tone and especially when the patient is susceptible to iodide rash. Ultraviolet rays will arrest the papular eruption, but will not disperse it completely unless treatment is given every day or so. Cod liver oil, if borne well, is beneficial.

Of the twenty-four patients who were treated surgically at the clinic, eleven have lived for one to nine years. Of these eleven patients, nine are well, according to latest available records. Two are still under treatment, one of whom has a fecal fistula, but is otherwise well, and in one of whom a sinus persists. Seven of these eleven living patients received open surgical treatment, ten were given radiotherapy, and all eleven received medication. Thirteen patients are dead, all of whom died within the first year of the beginning of treatment. Of these thirteen patients two received open surgical treatment, three were given radiotherapy, and twelve received medication.

In conclusion, although medication with iodides in some form, in conjunction with radiotherapy and open surgical treatment, is the proper procedure, stress should be laid on close observation of the treated wound in order that reinfection of the tissues contiguous to the operative tract shall not occur.